FLAIR

OPERATOR'S MANUAL

VERSION 5

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CHAPTER 1 - INTRODUCTION

About this manual:

This manual is designed to be used as a reference guide rather than something to study before you touch the machine. The Quick Guide should be enough to get you up and running, assuming that the motors are all connected and set up. The rest of the manual is divided into reference sections, which should allow you to easily get assistance on any area of running the program.

There is an extensive glossary at the back of the manual, and you must refer to this if you come across any term that you are not familiar with or not sure about. It is also possible that we use terms in a way that is unfamiliar to you. If anything you come across does not make sense, please do check the definitions of any words in the glossary to help resolve this.

If you have any suggestions for improving this manual or areas that you find hard to handle, please let us know and we will take them into consideration for the next manual release.

Safety

Safety is a very important aspect of any system and must be kept in mind at all times especially with motion control equipment getting faster and more powerful. The level of safety at which the system is operated is very much up to the user, and he must be continuously aware of what is happening with and around his system.

Here are some safety rules, which must be obeyed to ensure safe operation:

1) Always have one person ready to press the red Emergency Stop button when there is power applied to the system.

2) Always watch the system, not the video monitor when you are operating. The video monitor gives a very narrow field of view, and will not tell you if someone is sitting in the way of the rig. If you want to watch the move, record it and watch it played back.

3) Do not allow people to stand on or near the system unless that is specifically required for the shoot, and make sure they know when the system is going to move. Also provide them with a clear path to move away from the rig if this is required.

4) Always install track buffers on the rails, and place them as close as possible to the end of the move. The same is true for lift buffers if these are fitted. This also applies to end limits, which will turn the axis off if it goes out of the intended envelope of operation for that move.

5) Be aware of the back of the rig and how it moves as you rotate, the back end will move in the opposite direction of the arm, and you have to allow clearance for this.

6) Turn the system off whenever you leave it, or at least disengage the motors and depress the emergency stop. If you are leaving the rig alone, then the area should be locked or someone should be there to ensure no unauthorised persons get near the system.

7) Always test fast moves slowly and bring them up to speed bit by bit. This is particularly true if you are part running or running with preroll or postroll as the size of the preroll or postroll increases as the square of the speed. i.e. if you double the speed the movement will quadruple.

8) Always announce loudly when the rig is about to move if there are actors or crew in the studio as they may not always be able to see the rig.

9) Do not operate the system while under the influence of alcohol or drugs, even medical ones unless fully cleared by your doctor.

About the software:

The best way to learn to use the software is to try it out. There is a negligible possibility of damaging the computer or software through use so if you want to know how it will work, try it out. However it is possible to damage the rig, particularly if not properly or fully set up. If you are concerned about this, keep the emergency stop nearby at all times and try all moves slowly before running them at full speed, as covered above.

This manual is intended as a user's guide to the software, it is not a specification for the software and features mentioned in this manual may or may not be available on the system you have bought. Mark Roberts Motion Control reserves the right to remove, add or alter features from those listed in this manual without prior warning.

CHAPTER 2 - INSTALLATION

Installing the program:

Flair is installed under Microsoft Windows. The program is installed using an automated installation program. Flair can run with or without any motion control hardware. If it does not detect any hardware or if it has been set not to load any hardware then it will start as normal but will not try to "talk" to any motion control hardware. The minimum requirement for Flair is Windows 2000. FlairSetup.exe is the automated installer for Flair. Multiple versions of Flair can be installed on one computer. The installer is either run from a CD or downloaded from the website, saved in a suitable location (such as the desktop or the documents folder), and then run. Once the installer is started it will prompt you by asking what you would like the program to be called in the Windows Start Menu (default: Flair). It will also prompt you for which directory to install the program in on the hard disk (default: Program Files\Flair). Most importantly, it will ask whether you want a New Installation or are Upgrading an Existing Installation. If you have not installed Flair before then choose a new installation, but if you are only upgrading the Flair version and don't want to lose your configurations then you MUST choose Upgrade. If you do not it will overwrite your existing configurations and you will lose the set-up of your rig. It is strongly recommended that you make a backup of the Flair directory prior to any upgrades for total security. Once installed, you can access Flair, Flair documentation and various additional functions through the Start Menu in Windows.

Starting Flair:

To start Flair either click on one of the Flair shortcut icons on screen or select Flair from the Start Menu. If you have made a new installation of the program Flair will check you have a suitable license installed. If you do not it will allow you to run the program but certain functions will be disabled. Please contact MRMC if you require a new license. If you are using Flair to run some hardware the program will bring up various messages indicating which board it is currently loading. Remember to have your hardware plugged in and switched on or else the program will fail to load. When completed Flair is ready to run.

Hot Booting

Hot booting is the action of reloading a previously run program without losing axis positions. For example, the user may have accidentally closed Flair, or a software conflict may have caused Flair to quit unexpectedly. Hotbooting will re-start Flair without resetting all the axis boards and will save the axes positions. To do this, hold down the CTRL key when clicking on the Flair icon to start the program. Assuming that the fault was not hardware related or that the hardware has not been switched off, Flair will load with all the current axis positional data. You will have to read the last stored job from disk to get the move data back. Older versions of Flair used to save the move data, but this feature has been lost in exchange for faster programme execution.

The Importance of Datasaves

Normally a Mark Roberts Motion Control system comes fully configured with the Flair software already installed for the customer. All the customer has to know about the software files is how to start the program – Flair – as in the section "Starting Flair". However, we recommend you also make regular "datasaves" of your system and keep some copies for yourself and also regularly send copies to Mark Roberts Motion Control. Datasaves are simply copies of your configuration files and Flair program version for backup and diagnostic purposes. These datasaves are **vital** for restoring a corrupt program, copying Flair to a replacement PC (either because of PC failure or simply for PC upgrade), and reporting bugs to Mark Roberts Motion Control. Doing a "Datasave" has been fully automated and is listed at the bottom of the "Setups" pull down menu. Select the "Zip Setups" option and save it to a filename that includes the name of your company so that MRMC can tell whose it is and then use the "Email Setups" to send the file via your standard email server.

Flair features an Auto Backup option which can be enabled from:
File → Backup Location → Auto Backup Stored Jobs? If this box is ticked, Flair will run automatic backups of your data periodically.

Files Installed and changed:

The most important file the user should be familiar with is the Flair Initialisation file, flair.ini. It sets up exactly what features your software has or doesn't have, how many axes to run and so on. The Technical Chapter at the end of the manual gives some of the options the user can change.

The rest of this section is for experienced computer users who wish to know more about the installation, it should not concern the average user and is supplied for information only.

FLAIR.INI	; Initialisation file that configures the software for your specific use. Changes such things as the number of axes etc.
AXIS.DBF	; Configuration file for axes.
CONFIG.DBF	; Configuration file for miscellaneous parts of the programme.
LENS.DBF	; Configuration file for lenses used by system.
CARTS.DBF	; Configuration file for Cartesian Limits.
SERIAL.DBF	; Serial Devices configuration file
KINE.XXX	; Kinematics configuration file, last 3 letters vary.
MODELS	; Directory of model parts for the graphic rig representation.

Some of the files may be missing if they are not applicable to your system, and if you have multiple applications, then there may be more files.
Additionally there are normally some documentation files including this manual.

Directory Tree Overview of typical installation

Additional files than the ones listed may be present, this lists the minimum files normally installed.

Flair

	JOBS	CONFIGS	BTLS
Flair5.exe	(Job files)	AXIS.DBF	AXIS_403.BTL
Flair5.ini		LENS.DBF	Quad_Axis.BTL
		CARTS.DBF	RIC.BTL
		CONFIG.DBF	ROOT.BTL
		VTRS.DBF	RTC.BTL
		SERIAL.DBF	SERIAL.BTL
		KINE.XXX	Winroot5.BTL

There may be some additional log files that are generated while running Flair to aid in diagnostics. These include Flairout.txt, FlairLoad.txt, FlairData.txt, Rootout.txt and Flairout.txt. The amount of diagnostic data that the log files contain depends on the Debug Level specified in the Flair Configuration File (Flair5.ini).
New program versions may be added. See the section “Advanced Configuration”.

CHAPTER 3 – QUICK GUIDE

The Quick Guide:

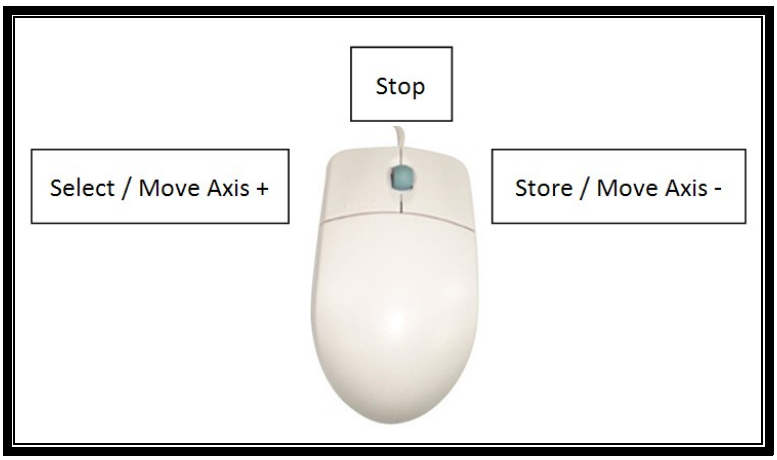
This is a very short quick start guide to Flair. The rest of the manual is more of a reference manual than a guide.

The quick guide is intended for a new user who just wants to make some simple moves. It assumes that the system has been fully set up and is ready for use. For more in-depth information, turn to the relevant sections of this manual. Given a system that is correctly set up, and has been left in its correct zero position, a new user should be able to start shooting moves within a very few minutes!

As you read this guide do each step as it is described and you will discover how easy the system is to run. Don't read through the whole section first and then try to use it as you need to actually use the system to fully understand each step.

Several of the functions described here can be done with either the mouse or with keys on the Hand Held box. This guide has been written using the mouse features in every case, but you can also use the hand held box if you find it easier or quicker.

Mouse Operation:



The program is designed to run with a 3 button mouse; it can be run with a 2 button mouse, but this is NOT recommended.

The left hand button fulfils the normal mouse function of "select". When the cursor is over an item, pressing the left hand mouse button will cause that item to be selected and if it is a push button of any kind, it will be pushed. Active or selected items often have a red or black highlight around them so you can easily tell which item is active. This is important to know as key presses on the keyboard are only directed at the active window or item; i.e. if you want to type something into a box, you have to click on it (select it) first! This button is referred to as the "select button" and if you are instructed to "select" an item, that means move the cursor above the item and click the left hand button.

The middle mouse button has a special purpose which is to ‘stop’. Whenever it is pressed, whatever the software is doing is stopped. If it is pressed while the move is running, then the move is stopped. If it is pressed while something is being printed, then the printout stops. If you press it while the rig is already stopping, it will stop even faster. This is a safety feature to aid the user; it does not replace the emergency stop button and should not be regarded as fail-safe. This button is referred to as the "mouse stop button". It does not work if the mouse is off of the program screen or on the border of a window. In certain graphical displays, this button may be used for other purposes. Additionally the tilde key “~” and the space bar can also function as stop buttons.

The right hand button is used to store data. If you want to store data into the program, then pressing the right hand button over a box will store relevant information into that box. This button will be referred to as the "mouse store button" and its exact operation is covered under relevant sections of the manual. As with the "stop" button, this function is used differently in certain graphical sections of the programme. In some cases when it is appropriate, a right click will cause the setup appropriate to that button to appear. Generally “store” works for numerical boxes, and “setup” for push buttons where it is appropriate.

Using the Mouse to Move an Axis:

The Mouse has an additional function in that it can be used to move any axis around. Often this function is done using the Hand Held Box but the mouse can be used instead or in addition to the Hand Held Box. To move an axis one places the mouse pointer over the number shown above any axis name on the main numerical screen (which will shortly be described) and presses the left or right mouse buttons to move the axis in a positive or negative direction respectively.

Numeric Entry:

Motion Control is intimately connected with numbers, and you will sometimes have to type numbers in to let the program know different values e.g. camera speed etc. etc. Numerical entry is consistent throughout the program and is done in the following manner: 1) Select the relevant box. 2) Type the value in newly (you can't edit the existing value) 3) Press either of the "Enter" keys on the keyboard. If you make a mistake while you are typing, you can correct it with the backspace delete key (usually marked with an arrow pointing left and directly above the large "Enter" key). The value is entered once an "Enter" key is pressed. If you change your mind half way through typing in a new value, pressing the "Esc" key will abort the change and return the number back to its original value.

In numerical entry, only certain keys are valid; these are the number keys, +, -, the decimal point, the "Enter" keys and the backspace delete key. The minus keys and the decimal point key are only valid if the value can be negative or fractional respectively.

Alternatively in certain circumstances, the mouse store button can be used to directly enter a numerical value. For example when you are storing an axis position, you can place the cursor over the box you wish to store the data into, and by pressing the mouse store button, directly enter the data into that box.

All numeric entry buttons also support a rudimentary calculator function. If you would like to add or subtract an amount from the value, type the amount, and then press the "+" or "-" key. You may also multiply and divide by an amount by typing the amount and then typing the "*" or "/" key. If the box is for integer values only, then you will not be able to type in a non integral operand. If the value resulting is out of the range of the box, you will get an error and the original value will remain.

Numeric Display:

When the program first loads, you will be presented with the Numeric Display. The numeric display is composed of lines containing data about frame counts and motor positions for those frame counts. Each of these lines is called a waypoint, and when the move is executed, each motor is driven from one waypoint to the next at such a speed that it arrives at the position specified in the next waypoint at the correct time. If there are more waypoints, it will then continue on to the next one. This is the simplicity of Motion Control. When the program first loads, there is only one line, and the positions for this line are blank, after few lines have been added, the display could look like this:

			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	100000.00
Frame	Posns	Target	Track	Lift	Rotate	Extend	Angle	Pan	Tilt	Roll	Focus
0	1	26.16	568.669	4.256	67.256	52.238	33.825	89.579	-43.072	-46.329	**26.16**
113	2	48.00	542.445	8.005	57.000	51.456	45.000	32.520	-21.210	-37.963	**48.00**
147	3	51.84	507.569	7.589	23.235	45.250	27.449	74.764	-30.711	-34.193	**51.84**
198	4	70.13	497.856	11.236	20.560	40.137	22.321	91.754	-45.060	-43.490	**70.13**
214	5	76.46	490.256	6.257	54.000	39.639	20.173	95.989	-40.603	-41.060	**76.46**
256	6	242.62	447.366	5.555	52.267	35.223	19.336	88.199	28.207	-28.054	**242.62**

The frame count column is down the left hand side of the screen, and frame count numbers are entered in here by selecting the entry you want to change with the mouse so that a black square appears around it, and then typing in the new value followed by the "Enter" key. The next column is the position number, and is to let you know which position line you are one. If you have more than about 16 lines, then they will scroll up and down, and then this line numbering becomes vital. The next column "Target" is optional and may not appear on your system; it is not necessary for simple moves and is therefore covered later in the manual.

The rest of the screen is filled with axis positions in vertical columns, with the axis name at the top, and a position stored in each waypoint that is entered. If there are more than about 8 axes, then the other axes can be scrolled sideways so that you can get to them and inspect or modify their positions. Axis positions are modified in the same way that frame counts are; simply select the number you want to change so that a black square appears around it and then type in the new value followed by "Enter". Normally positions are entered into these boxes by telling the computer to "store" the current axis positions using the mouse 'Store' button.

Moving the Motors:

When the system is first powered up, no motors are engaged, the user has to enable them. The first thing to do is to turn on the power to the amplifiers by letting out the red emergency stop button and pressing the small red reset button, this will usually result in a loud click as the switches in the power supply close. The state of a motor is indicated by the colour of its axis name near the top of the numeric display, and by the colour of its "current position" which is directly above. If the axis name is white (or grey), that indicates that it has not been enabled - simply click on the axis name, and it should go black indicating that the user has enabled the motor and wants it to be engaged (under control of the system). If this is successful, then the current position, which was also white, will go black.

In this diagram, the Lift is enabled and under power, the Track is enabled, but has not engaged and the Rotate is not enabled, and therefore is not engaged. In summary: the colour of the axis name shows if it has been enabled by the user, and the colour of the current position shows if it is engaged and in the correct position.

Use the Hand Held Box or the mouse left and right buttons as above to move the motors. Use the + and – keys to change the speed.

Programming a Move:

Now start programming the move. Use the mouse to move the camera to the correct position for the start of the move, then select the first line on the numeric display, and click on the "Store" button on the side menu bar to the right of the axis positions display. (If the “Control Menu” is displayed, click on this label so that the “Editing Menu” is displayed and then the “Store” button will be available). This will store the current positions into the first waypoint. Next move the camera to your second position (moves need at least 2 positions), press the "Add Line" button to add a second waypoint to the display, then press the “Store” button again, and the new positions will be stored into the second line. If needed, change the frame count of the line to the desired frame count, and then continue adding and storing waypoints until the move is entered. Note that frame counts must always increase through the job, getting larger and larger with each waypoint. A simple 2 point move could look like this.

				0.000	8.200	26.850	50.389	27.433	48.598	-31.199
	Frame	Posns	Target	Track	Lift	Rotate	Extend	Angle	Pan	Tilt
▲	0	1	26.16	568.669	4.256	67.256	52.238	33.825	89.579	-43.072
	100	2	48.00	542.445	8.005	57.000	51.456	45.000	32.520	-21.210

Running a Move:

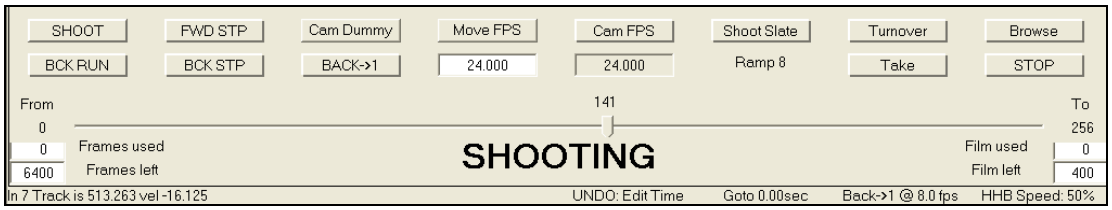
Any programmed move can be run from the beginning to the end, from the end to the beginning or from any time within the move to any other time in the move. The simplest form is to run from the beginning to the end; this is called a "Forward Run"

or "Fwd Run" in its shortened form. There are several ways to do this, there is a “Fwd Run” button on the top menu bar, there is also one under the “Run Job” button on the top menu bar, there is also one on the Hand Held Box or you could simply press the “F2” key on the keyboard.

When one of these buttons is pressed, the move is calculated and, if the move is not too fast, the computer will prompt you with "Ready to Goto" which means that the current motors positions are not the same as the move start positions, and the motors must move to the start position before they can run the move.

There is a control box at the bottom of the screen which displays the status of the job and holds the control buttons for running the job. In order to make the system execute a goto, you press the "Goto" button with the mouse. The motors will then move to their respective start positions, and the message will change to "Ready to Shoot". In this state or any of the Job running states you cannot input into the system.

At this point you can run the move. Press the "Shoot" button, the motors will start moving and the slider at the bottom of the screen will also start moving to show the frame count as the move progresses. When the moves completes, the motors will come to rest, and the system will return to its normal input state.



You can also run the move from the end back to the beginning. The procedure is basically the same as the above, press the "Back Run" button, press "Goto" if you are so prompted, and then "Shoot".

If the computer calculates that the move is too fast for the motors to run at that speed, it will suggest a longer overall frame count for the move or a slower camera speed. You can either Apply the increase in frames, or modify the move (e.g. lower the camera speed or reduce the distance to be travelled).

Modifying a Move:

If the move does not go in exactly right first time, there are many ways in which the move can be modified. You can insert, delete or modify waypoints. Deleting waypoints is done by selecting a line (so that the black square appears somewhere on that line) and then pressing the "Delete Line" button in the side menu bar, this will totally remove a waypoint. Waypoints can also be inserted. Insert is actually "insert before", so when you select a line, and press the "Insert Line", a new line is put in above the line you selected. This can be used to enter a new waypoint between 2 existing waypoints.

A good way to change a move is to move the system to one of the waypoints using the “Go To” button on the Top Menu Bar, and selecting position from the list that appears, and then typing in the number of the position you want to go to. The system will then say “Ready to Goto” and will move to the desired position when “Goto” is

pressed. Once at the waypoint, correct the positions, re-store the waypoint and then re-run the move. This is the preferred method as adding and inserting waypoints can make the move too complicated and can spoil the smooth shape of the move. If an existing waypoint is wrong, move to that waypoint and make it right, then select it and re-store the new positions.

Recording a Move:

Once the move is to your liking, you are ready to record it.

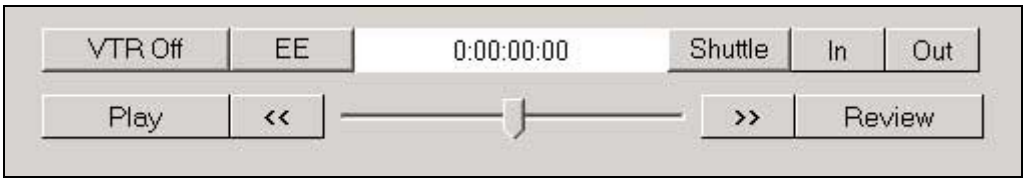
Film

With a film system, you have to engage the camera which is done just like the other axes; simply press the "Frame" button at the top of the numerical display, the camera will engage and zero itself. Then change the button on the Run Control Bar that says "Cam Dummy" to "Cam Record" as above and run the move. At the beginning of the move, the camera will be started, and then the move will be shot with the camera running throughout and at the end of the move, the camera will stop. If you have electrically controlled Take Ups, these should be tensioned before the move is shot; press the button at the bottom of the side menu that says “TUs Slack” and it will change to "TUs Tensioned" and the take ups will turn on.

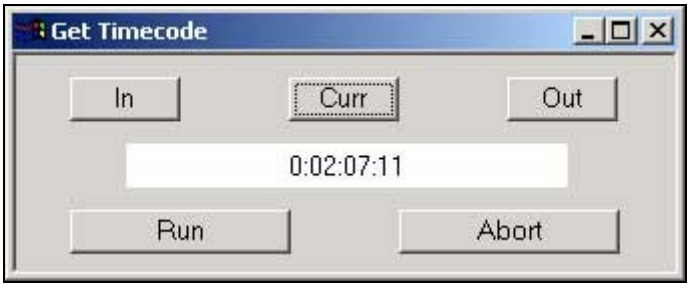
The system has numerous advanced features that allow you to change the move in other ways and to affect the shape of the curves, but the above guide covers the basics, and should allow you to do repeat or multiple passes of the move you want.

Video

On a video system, a move is recorded by pressing on the button on the Run Control Bar that says "VTR Off", and it will change to "VTR Record".



When the move is run, you will be asked for a starting timecode for the recording. This is typed in, and then when the move is shot, the VTR will be controlled to record the move onto tape.



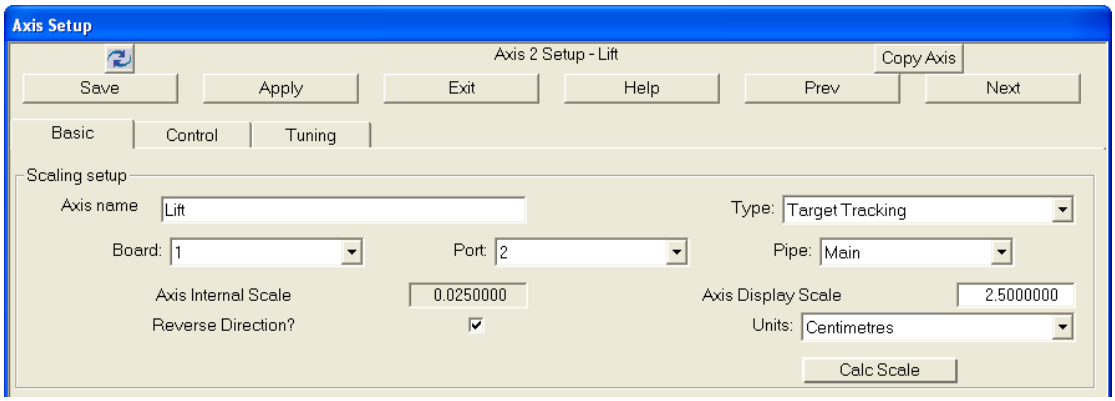
CHAPTER 4 - SET-UPS

Axis Set-up

Each axis has its own Set-up which can be changed by the operator. When changes are made, they can be saved permanently to disc by using the SAVE button on the screen, they can be applied to the axis by pressing the APPLY button on the screen, or the changes can be ignored by pressing the EXIT button. (Note that this does not apply to motor tuning as these changes are applied immediately for safety reasons). Since most systems have many axes, you can switch between the Set-ups for each axis by pressing the "Next" or the "Prev" buttons to look at the next axis Set-up or the previous one.

Title: The Axes are identified by a number, and this is displayed in the title bar and in the top line of the axis set up display.

Basic Tab



Axis Name: This is a text area, and any name can be typed in here as you wish. Note that changes to this field will only be permanently recorded if the "Save" button is pressed.

Axis Type: There are several types of axes. The 2 most commonly used ones are "Target Tracking" and "Independent". This field sets up how the motor is controlled.

- Independent: An independent axis will simply move exactly as it has been programmed from point to point. Its motion is programmed in numbers and it will execute that motion regardless of other axes.

- Algorithmic: This mode allows a motor to be controlled by the position of another motor or encoder input through a relationship table. (See below – "Lookup Table")

- Target Tracking: A Target Tracking axis is one whose position affects where the camera is or in which direction it is looking. When you are in the program's Target Tracking mode, the position of a target tracking axis is determined not directly from the entered numeric positions, but from the

intended position of the camera and target. Typical Target tracking axes are Lift, Pan, Tilt etc.

- Master Type: This is a specialised axis which behaves just like an independent axis, but whose position is important to the Target Tracking geometry because it affects the camera's position. Typical Master axes are Angle and Extend.

- Focus Type: This is used to identify the focus axis to the system so that it can be used as a computer controlled focus when a lens has been fully set up; see that section of this manual for more details. There may be only one focus type axis.

- Zoom Type: This is used to identify the zoom axis to the system. A zoom's motion can be controlled in special ways so that the focal length is known or so that the apparent field size changes in a linear fashion. There may be only one zoom type axis.

- Iris Type: This is used to identify the iris axis to the system so that it can be used to change the stop on the lens in a specified manner and so that it can be used to adjust for changes in exposure due to changes in the camera speed. You are also allowed only one iris type axis.

- FDX Type: is used for a Fade Dissolve system. Mostly used on animation stands, the FDX axis can be programmed to automatically do a dissolve between one scene and the next.

- Shutter: Used to identify an axis that has direct linkage to the shutter angle of the system. It can be programmed normally as an independent axis and also can be used to vary the exposure and thus adjust for changes in camera speed.

- D to A: When an axis controls a voltage level and there is no feedback. This method is used to control such things as a light level or even a simple voltage controlled servo, but please note that these are generally not perfectly repeatable due to the analogue nature of this control method.

- Min Aux: Stands for "Miniature Auxiliary" This axis can be used as an additional way to adjust a Target Tracking move, and this subject is covered further in the advanced Target Tracking section.

Axis Board: This is the board number that the axis is assigned to. The first board is 1, and it goes up to the maximum number of boards on the system. 0 is not valid. If there is a mimic board in the system, ignore this in counting the boards as the software automatically takes it into account.

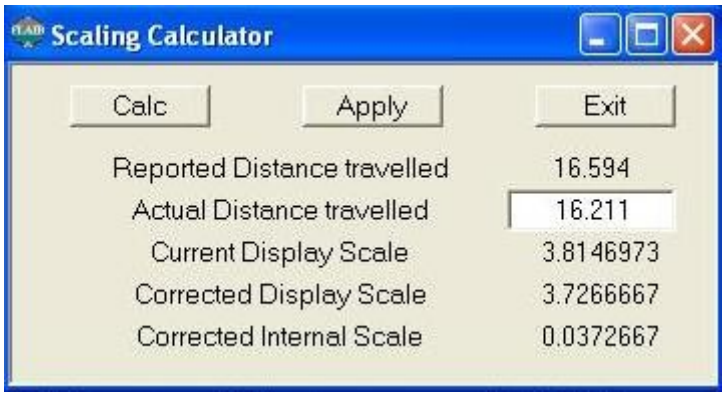
Axis Port: This is the port number on the axis board which the motor is connected to. It can be 1, 2, 3 or 4. Consult you documentation if there is any problem, but normally, this will be obvious, clearly documented or already set up.

Axis Network: The new hardware (RT10) has an additional axis board network which will be developed to allow 2 separate axis "networks" to be attached. This will mainly be useful for model movers or additional mimic handwheels.

Axis Internal Scale: The internal scale of the axis is used to convert the motor position into standard scientific units of Metres and Radians. See Axis display scale for more data.

Axis Display Scale: All motors have encoders on them; these produce pulses which the axis boards count. The scaling factor is used to convert pulses into usable units such as inches, degrees, centimetres etc. The correct value can be set up by zeroing the axis directly at a known point, moving it through a known distance, then adjusting the display scaling until the distance reported on screen matches the measured distance. For example, point the camera at something, zero the pan directly, and then turn the camera right around until it is looking at the same target again. This should give a position read out of 360 degrees. If it doesn't then adjust the scaling factor until it does. The Internal Scaling can be calculated from this. (See "Display Scale Units" below).

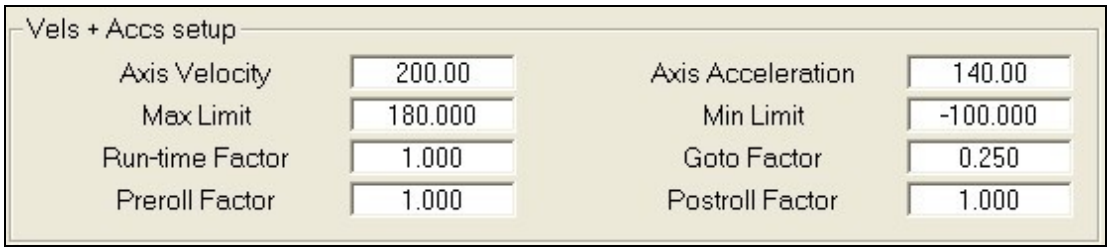
Calc Scale: This button will pop up a box that allows you to correct the axis display scale if it is incorrect. Once the axis has been moved an exact known amount, pop up this box and enter the distance the axis has actually travelled (not the distance the computer says it has travelled). When the "Calc" button is pressed, the new scaling will be calculated and will appear on the pop up box. If the user wishes, he can then press the "Apply" button, and this new value will be entered into the Axis Set-up, but will not take effect until that Set-up is accepted by the user.



Axis Direction: This switch can be used to reverse the direction of the motor. When an axis is moved, its position will increase or decrease; for target tracking, it is very important that axes are considered to move in the correct direction. For pan and rotate axes, +ve movement is considered to be to the left looking from the back of the camera. For a roll axis, this is anti-clockwise looking from the back of the roll. For any lift axis, a positive movement is that which moves the camera higher. For a track, positive movement is along the track in the direction that the camera is looking when the pan and rotate are correctly zeroed. For a focus axis, forwards is moving away from infinity focus.

Display Scale Units: This is a pull-down selection of various units' types that when selected will calculate the correct Internal Scale Based on the Display Scale. Once the Display Scale has been correctly worked out so that the motor position is displayed in the desired units, select the pull down menu to the right of the "Display Scale Units" label, and select the units you have scaled the axis in (supported units are Metres, Centimetres, Millimetres, Inches, Feet, Degrees and Radians) When the unit is selected, then the Internal Scale is worked out based on your selection and the Display

Scale for that axis and the Internal Scale window will be disabled. Note that the Internal Scale will be automatically updated if you change the Display Scale. If you have scaled your axis in an unsupported unit, then you will have to work out the correct value to convert the axis position into Metres or Radians, contact MRMC if you need assistance.



Axis Velocity: This is the maximum speed the computer will allow the motor to go. It is in display units per second. If your motor is a rotational motor scaled in degrees, then the velocity is in degrees per second. Any motor will have a top speed; this is governed by the motor, its supply and the mechanics it drives. The Axis velocity should be set to the maximum speed the motor (or your nerves) can take. In general the user will have been supplied with the approximate maximum speeds of the axes, and these can be typed in directly. More detailed setting up is covered later. It must be noted that changing this number will not magically make the motor go faster; it is only a number which is used to work out how fast to do Gotos, and is used in checking that a job will not go too fast. It does not affect the performance or behaviour of the motor in running a move in any way. If you attempt to execute a move that requires a higher axis velocity than the entered value, the computer will refuse to run the move, and will suggest a higher number of frames for the move.

Axis Acceleration: As above with Axis velocity except that the units are display units per second per second. If an axis accelerated at its maximum acceleration from a standing start, after one second it would have reached a velocity numerically equal to its acceleration. e.g. if your motor's maximum acceleration were 100 centimetres per second per second (100cm/s*s), then after a second's acceleration, it would be travelling at 100 cm/s. The value is in fact usually similar to the maximum velocity. Detailed setting up is covered later. As with the axis velocity, this value is used in Gotos and also in checking a job to see that it does not exceed the capabilities of the motor; it does not affect the performance of the motor in running a job. If the computer determines that the acceleration required to execute a certain move is greater than this value, an appropriate message will be produced and the move will not be run.

Max Limit & Min Limit: The allowed range of travel of any axis can be set up so that it does not exceed certain limits of travel. There are 2 limits, one is the Minimum Limit and the other is the Maximum Limit. Obviously, the minimum limit is the lowest number to which the axis can go and the maximum limit is the greatest limit to which it can travel. These limits are used when controlling the axis from the hand held box and also are checked at run time to see that the move does not exceed the allowed limits of travel. These limits are NOT checked when the axis is mimic controlled in "Encoder Pos" mode which is described below. You can also disable the limits by blanking out the field which is done by pressing the backspace delete key (←) in that box. These limits can also be overridden for manual control by using the Limits Override key on the Hand Held Box.

Factors: There are 4 "Factors". Each of these is used to limit the maximum velocity or acceleration of the system at different times. Allowed values are .001 to 1.0, the value is a straight multiplication factor. If you set the Goto Factor to 0.5 then the maximum speed reached in a Goto will be limited to 1/2 of the maximum velocity.

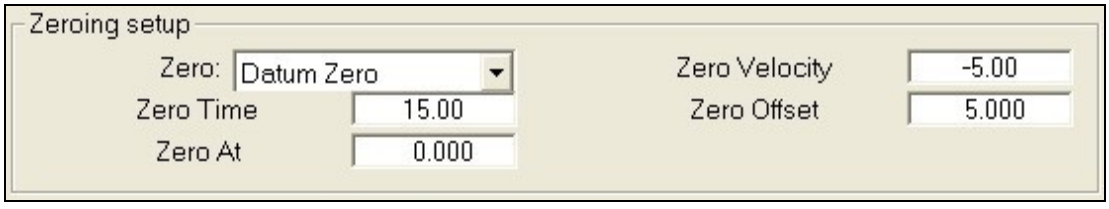
Run-time Factor: This factor is the factor used when checking the job. The basic idea of this is to allow the user to set up an absolute maximum velocity in the axis velocity field and then to be able to say "Yes, I know it WILL go that fast, but I would rather limit it to say '90%' of that speed for normal jobs, knowing that I can change the factor to 1.0 when I need full speed". This factor also controls the maximum acceleration allowed in running a job. Note that part-runs do not check maximum velocities and accelerations.

Goto Factor: This controls the fraction of the axis velocity and acceleration that is allowed when performing "Goto"s or "Move To"s. If these are performed at maximum speed and acceleration, it can worry the client (and the owner), and usually these are best done at about 1/3 speed and acceleration. Note that this value is also used in single stepping a job as the rig will "Goto" the next frame position automatically. This movement can sometimes be a little too fast and can cause the rig to shake, by reducing the goto factor on the most afflicted axis, this effect can be handled.

Preroll Factor: This factor and the Postroll Factor are different from the above in that they only affect the acceleration, and not the velocity. If you have a move that starts with a velocity, either because there are no fairings or because you are part running a move, then the motors have to "preroll" before the actual move itself starts. This means that when the move starts, they have to be travelling at the right speed, so they will run back and then forwards in order to achieve this. The velocity they end up is governed by the move, but the acceleration they use to do this is controlled by this factor. If the axis prerolls too violently, then reduce this factor, it is takes too long, then increase this factor (or set the maximum acceleration correctly).

Postroll Factor: As above, but this controls the end of the move or the end of the part run. It also controls the stopping speed when you stop the motion in the middle of a move. If you press the stop button, the rig/table will use the maximum acceleration reduced by this factor to slow down and stop. If you press the stop button twice, then the rig/table will use the full maximum acceleration to stop.

WARNING: For both the Pre and Post rolls, if these values are set too low i.e. 0.1 or such, then the rig may do huge pre and/or post rolls, possibly exceeding its limits of travel and/or colliding with the set. These factors should initially be set high (at least 0.5) and only reduced when the rig is fully set up.



Zero: There are several zeroing styles which the user may need to know about. For a fuller description, see the Chapter on 'Zeroing'. There are 2 basic versions, either

Direct Zero which sets the position at which the axis is now to zero, so it is up to the user to position the axis correctly, or any of the other methods which seek a reference point, and then move a known distance away from it.

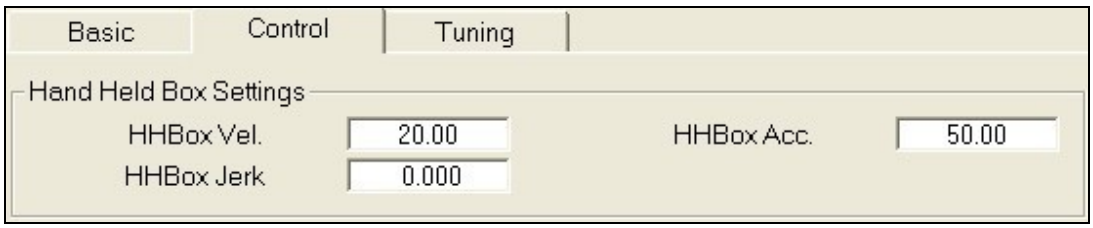
Zero Velocity: The speed at which the axis will seek its reference point (The direction is set by the sign). This should be set low at first. It is in display scaled units just like the maximum velocity.

Zero Time: This is the time allowed for the axis to find its reference point. If it does not find the point within this many seconds, then the zeroing process will stop.

Zero Offset: Once a reference point has been properly located, the axis will move a given distance from this point back to its normal zero position, this is known as the Zero Offset. When the mouse store button is clicked over this box, the axis current position is added to the value currently displayed. This is useful for making small adjustments to an existing zero. Alternatively you may set this value to 0 first or use the mouse middle button, then the current position of the axis is entered into this box.

Zero at: Once an axis is zeroed, its position is set to 0.0. If the best position for it to zero at is not necessarily zero, then a value can be set to its position once it has completed the zeroing process. This can be useful for conditions when axes are offset, see the Chapter on Zeroing for more data.

Control Tab

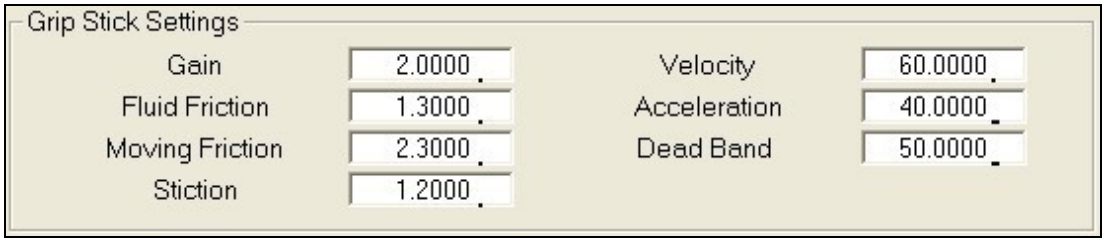


HHBox Vel.: This controls the maximum speed of the axis when being controlled by the hand held box. The hand held box should not normally drive the axis at maximum speed, about 50% is useful, however if you are doing a lot of close up work, then this value can be dropped to make exact positioning easier. It should initially be set so that the top speed on the hand held box is safe, and precise positioning work can be done at the slowest speed.

HHBox Acc.: When an axis starts moving on the hand held box, it will accelerate up to speed, the rate of its acceleration being governed by the HHBox Acceleration. This figure is usually about the same as the HHBox Velocity, higher for light axes and lower for large or heavy axes. Try moving the axis around with different setting, and you will soon get the feel of this. If the setting is too high, the axis will lurch, if the setting is too low, it will take a long time to get going and to stop.

HHBox Jerk: This box appears when certain additional features have been enabled by MRMC. Jerk is the factor that controls how much the acceleration can change, and as such can be used to produce smoother Hand Held Box motion. If this value is set to

0, then it is ignored and the normal Hand Held Box calculations are used. If a value is entered, then the acceleration will be eased in and out much the same way that the velocity is normally eased in and out. Due to this the movement will be smoother, but it may also take longer to speed up and slow down. A value that is about 3 times the axis acceleration is a good starting point. If the axis takes a long time to get started and a long time to slow down, then this value is probably way too low.

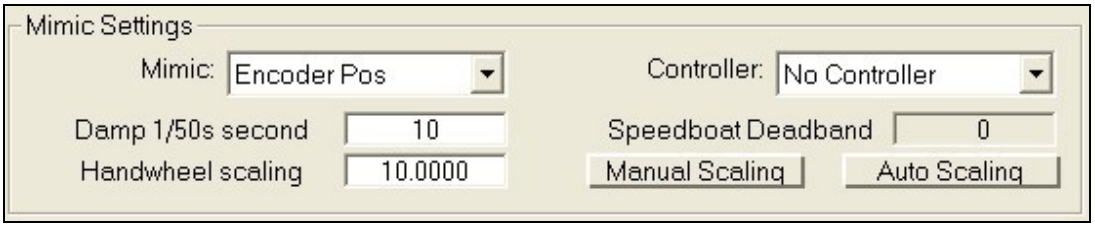


Grip Stick Settings: This section allows you to alter the tuning values assigned to that axis for use with a Grip-Stick. There are 4 tuning values: Gain, Fluid Friction, Moving Friction and Stiction. There are also settings for the Deadband and the maximum **Velocity** and maximum **Acceleration** to be used while under Grip-Stick control.

Gain: Amplifies the pressure applied to the Grip-Stick so that full acceleration can be easily produced. Too low a gain and the axis will be sluggish, too high a gain and it will take off too fast and will not respond to small changes in force on the Grip-Stick. The Friction and Stiction values are used to slow the system down if pressure is released or reduced. The Stiction effects how the axis starts moving from stationary, the moving friction is a constant effect to slow the axis down and the fluid friction is a similar effect, but is proportional to the speed of the axis.

Dead Band: is a setting that determines what range of force produces no motion at all. Since a Grip-Stick is somewhat temperature sensitive, this value should be set to about 200 or more to reduce the possibility of drifting. Values of 5.0 for the gain and 2.0 for the Frictions and Stiction are good starting points. When you press the "Apply" button, the settings are automatically applied to speed setting up. They will not be saved unless the Axis Set-up "Save" button is pressed. Please ensure that you are ready to press "Stop" or even the emergency stop button when setting up the Grip-Sticks as they can produce very fast motion.

Acceleration and Velocity settings: Since the operation of a Grip-Stick is different from the Hand Held Box and also different from normal axis use, the Grip-Stick operates with its own Acceleration and Velocity settings. During Grip-Stick operation, the axis will follow the limits of velocity, acceleration and travel, but the major difference with a Grip-Stick is that the axis responds to pressure on it as a demand for acceleration, whereas a normal joystick produces a demand for velocity. You will really have to try it out to see how it responds. Contact MRMC for details and costs. Grip-Stick operation is set up in the Hand Held Box Set-ups section.



Mimic Control: When an axis is mimic controlled, it can be controlled by an encoder or it can be controlled from the hand held box (if using Grip-Sticks, you should also select H.H.Box/GripStick). This pull down allows one to select from the different available options of control. The options currently available are "Encoder Pos" which directly controls the axis from another encoder."Encoder Pot" ensures that the mimic controller and the motor always stay in Sync; whenever mimic control is turned back on, the motor will first go to the current position of its mimic controller before the user can control it again, to bring the two in sync. This is normally used with a controller that has a specific limited movement range, like a focus hand controller that cannot move more than one turn. "Encoder Vel" if selected is active even if mimic is turned off and while copying closely any changes made with the controller, such as a handwheel, it pays attention to the maximum velocity and acceleration of the axis and won't allow them to be exceeded even if the handwheel turns faster.. "Speed Boat" which gives you a speed controller for the axis, very like the speed throttle on a boat. The centre position is off and forward moves the axis in one direction, backwards moves it in another.

Speedboat Deadband: With the "speedboat" control, it can be very hard to find the exact position for "stopped". Due to this, there is the facility to allow a wide area of motion to equate to "stopped". This is in encoder slots, so the actual range of movement it reflects will depend on the hardware.

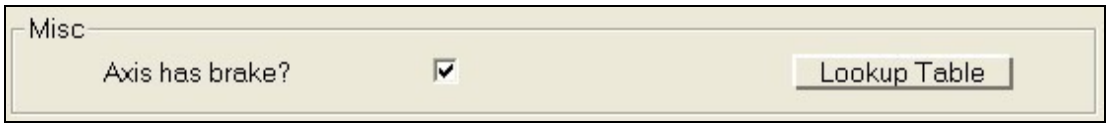
Damp 1/50s second: This is the smoothing window to be used with "Encoder Pos" control. It is the number of samples at 50 Hz over which it smoothes the motion. Thus 0 (the default value) is no smoothing and 20 is very heavy smoothing. Note that heavy smoothing will also introduce a slight lag into the response of the system.

Controller: If an axis is controlled from an encoder, you have to inform the software which encoder is controlling it. Usually, there are 4 possible mimic controlled inputs, so the controlling axis will be Mimic 1, Mimic 2, Mimic 3 or Mimic 4. If the axis is mimicking itself (auto-mimic), then the controlling axis is No Controller. See the Chapter on Mimic Control for more details.

Handwheel Scaling: An encoder controlled mimic axis can move at a faster or slower rate than the encoder that controls it. The desired ratio of velocities between the controller and the controlled is entered here. i.e. if you want the controlled axis to go twice as fast, then double this number. If you want it to go backwards then change the sign. These numbers must not be changed while the axis is moving. For an axis that is controlling itself, this value is automatically set to 1.0 by the software. When you are in Speedboat control, the scaling affects the how the motion of the encoder relates to the speed of the axis. With a scaling of 1, one turn of a 1,000-line encoder will produce full speed.

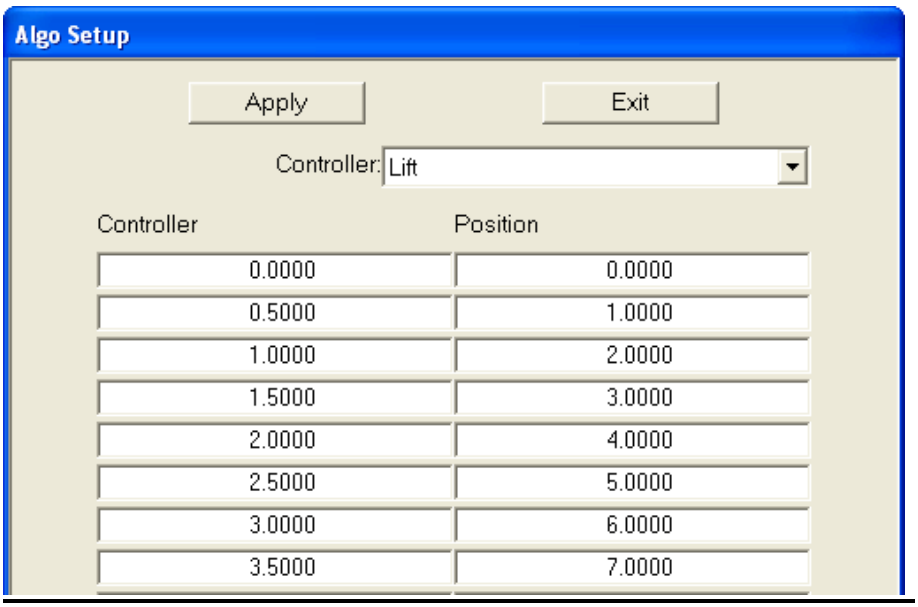
Manual Scaling: If you are controlling a lens (focus, zoom or iris) from an encoder pot with only 1 Turn, you can set the scaling so that one turn of the pot will give you full range of travel according to the set soft limits. Set the soft limits of the axis, and when you click on the 'Manual Scaling' button, a dialogue box will appear prompting you for the number of lines in the encoder. Enter the number of lines (e.g.: 1000, 2000 etc.) and click on "Calc" and the scaling for the axis will be set appropriately.

Auto Scaling: You can scale an axis to follow a controlling mimic axis using this dialog. The dialog allows you to move the controller to its limits and then the mimic scale will be set to allow full range of travel on the controlled axis.

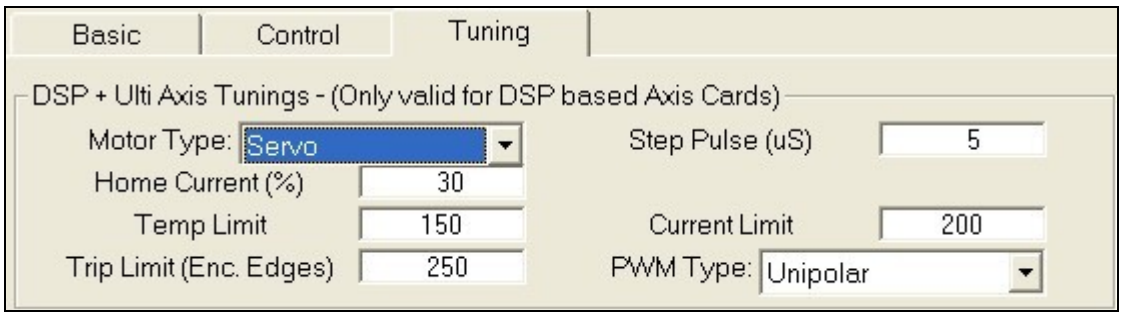


Axis has brake?: This is a toggle which states whether the axis has a brake on it or not. This will not affect whether or not the brake is released when the axis switched on. It is used to tell the software that the axis should not move when it is switched off. If your root box has a software-controlled e-stop (emergency stop), then if the axis is detected to be moving when the brake should be on, it will drop the e-stop. This is only available on systems that have this specific hardware. Please contact MRMC if there is any question about this.

Lookup Table: This button calls up a dialog box that allows you to state the relationship between a controlling axis and the one you are setting up. The first thing to ascertain is the controlling axis that you are going to use. Once this has been set, then you can simple store the related positions of controller and controlled by using the mouse store button. Please note that values must increase or decrease through the table, and cannot change direction. Old values may be cleared out of each column by pressing the middle mouse button on either the "Controller" labels or the "Position" label. Once this table has been applied, it should be viewable, but not editable in the Table Graph display. These points will be editable in the graphic display in a later release.



Tuning tab



DSP + Ulti Axis Tunings: These settings are only valid for systems with DSP based axis cards. This section allows the user to assign different motor types and configurations to different ports on the **same axis card**. This requires the latest version of the axis card firmware to be installed. If the axis's board has been loaded with a non-supporting software version, some of the fields may be greyed out and inaccessible.

Motor Type: This pull-down menu specifies what type of motor is being driven from this specific port. The available options are:

- **"Servo":** Select this if you are using a Servo motor on this axis.
- **"Stepper":** Select this if the motor being driven is a stepper motor.
- **"Stepper with Feedback":** Select this if the stepper has any feedback mechanism installed and flair takes this data in as an input through the motor cable.
- **"D to A":** Select this when using motors which require analogue voltage to run, like video cameras lens motors in general.
- **"D to A with Feedback":** Same as D to A but with an position feedback mechanism installed
- **"Preston Iris", "Preston Focus" and "Preston Zoom":** Select the corresponding Preston Motor type when using a Preston Wireless Lens controller. (Only applicable with suitable hardware).

Step Pulse (uS): Specifies the pulse width in microseconds of the step pulses generated by the axis card. Some older stepper amplifiers do not respond to very short pulses. Most modern amplifiers can handle pulses down to 1 uS.

Home Current (%): When homing a lens control motor, it keeps turning the lens back until the physical limit is reached. Therefore, to eliminate the possibility of a motor damaging the lens, this control allows the user to specify the percentage of the normal running current that the motor is allowed to draw when trying to find its home position. 20-30% should be a safe margin but different lenses may require lower settings. (This feature is developmental and is subject to change)

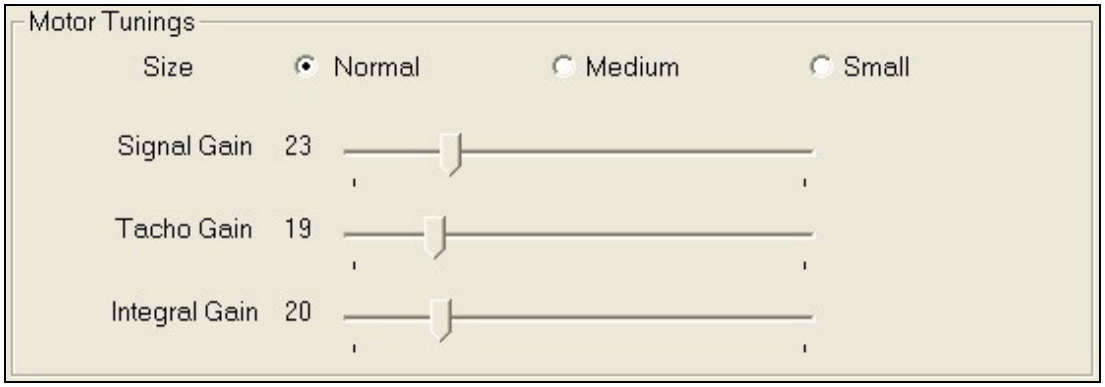
Please note that the values of the next 2 parameters are critical since setting them too high might allow damage to the motors. The absolute maximum value allowed by software is 255.

Temp Limit (only applicable on Ulti-Axis cards): Some amplifiers are equipped with temperature sensors. Flair can read the value of the sensor and make sure that the specified limit is not exceeded during the operation of the motor; otherwise it will disengage the axis. 255 is the maximum limit for the temperature sensor. This feature may be modified to read a temperature in degrees, but as of Version 5.11 it is a range from 0 to 255. Around 180 is cool, so the value should normally be set in the 200s.

Current Limit: (only applicable on Ulti-Axis cards) Specify the maximum current that the motor can draw at any time. 255 is the maximum limit for the current sensor. This feature may be modified to read a current in amps, but as of Version 5.11 it is a range from 0 to 255. 255 is around 6amps continuous.

Trip Limit (Enc. Edges): Specifies the number of encoder edges that the motor is allowed to lag from the controlling signal before it trips out. For a 1000 line encoder, Flair samples 4000 edges/rev, so 250 means the motor is allowed to lag behind the controlling signal by 1/16 of a revolution. For mimic applications, if the mimic input varies too rapidly, the motor might not have time to cope with that and the Trip limit needs to be increased.

PWM Type: Specifies the PWM type for stepper motors depending on the type used. PWM depends on the motor type and size. MRMC can advise on the setting to use for any particular motor. Unipolar should be selected for motors with low inductances (less than 1mH) such as focus motors and Ulti-Head pan and tilt motors, while Bipolar should be used on all other motors. Note: using Bipolar incorrectly can damage the motor.



Motor Tunings: The basic concept of positional servo motor control is that a sensing device on the motor is used to determine its current position, that position is compared to its desired position, and the error is then used to make an amplifier drive the motor to the correct position. If the correcting drive is exactly proportional to the error, then the motor would be driven rapidly to the correct position, and would promptly overshoot the correct position and then go into an oscillation around the correct position. Due to this, additional factors are used to stabilise the motor. The control model we have adopted has three controls: the signal gain, tacho gain and integral gain. These three controls are varied to get the motor to hold position correctly.

Motor Size: There are three setting for motor size. If you select Normal, then the tuning values are as represented. If you select medium, the values used are 1/5 of the

value shown and if you use small, then the values used are 1/10 of the values shown. Unless definitely required, it is recommended that you always use “Normal”.

Signal Gain: This basically controls the response to the error. If the signal gain is low, then the error will have to become quite large before it is driven to the correct position, if the signal gain is high, then even a small error will cause the motor to try to correct its position.

Tacho Gain: The system's response to the signal gain is limited by the tacho gain. If the tacho gain is too low, then the motor will oscillate (possibly violently). If the gain is too high it will be sluggish in its response, and the motor may tend to hum or buzz.

Integral Gain: Not actually intimately connected with the control of the motor like the above 2 controls. The integral gain slowly corrects for offset errors. If you have a heavily loaded lift, it will tend to sag out of position until the corrective force matches the displacing force. Having an integral gain will detect this offset error, and will increase the corrective force to minimise the error.

General Tips: Motor tuning is highly motor dependant and is also related to the resolution of the encoder. However, start with signal and tacho gains set to 5 and with low integral gain, and increase and reduce the signal and tacho until good behaviour results. The signal and tacho gains want to be about the same unless you have a low resolution encoder (less than 1000) lines when the signal gain may have to be appreciably higher than the tacho. As a general principle, 5, 5, 5 are good setting for small motors (smaller than your hand) 12, 12, 12 for larger motors (Pan Tilt etc.) and 20, 20, 20 for big motors. (Track, Lift).

Stepper Motor Tuning: When you are running a MRMC stepper axis board, the motor tuning is not actually critically involved in the motor control as there is no feedback from the stepper motor. However for the stepper board to work, the Tacho Gain MUST be set to 0. It is recommended that you set the other gains to 10.

Setting up an axis

The basic procedure for setting up an axis is as follows:

0. Set the axis board and port numbers on all axes according to the board and port the motors are connected to, consult MRMC if any problems. Ensure that no axes share the same board and port, and this includes the camera. An axis that refuses to move despite a reported changing position is either the wrong board and port, not connected or is being overruled by another axis in the same port on that board.
1. Ensure the motor is connected and plugged in, but leave the emergency stop pressed in.
2. Go into the axis Set-up for that axis and set the motor tuning levels to 5, 5 and 5. Select the axis type as Independent.
3. Set the display scaling to a sensible value, you can use 1.0, but it is unlikely to be greater than 500 or less than .01.
4. Set the soft limits to +500 and - 500

5. Set the Goto factor to 0.3 the Runtime Factor to 1.0 and the other factors to 0.75.
6. Set the axis velocity to the expected speed for that axis. If you are scaling a rotational axis in degrees, then about how many degrees per second do you expect it to go. If in doubt set this value low. Enter the same value into the axis acceleration.
7. Repeat for the HHBox Velocity and Acceleration and Apply the Set-up.
8. Release the emergency stop, and engage the axis you want to set up.

   Conditional: If the axis runs off briefly and then turns off, then it usually means that the motor leads are reversed. Handle and retry.
9. If the axis engages and the current position is now reported as black instead of white, then the axis is probably properly connected. If it is stays white even if you directly zero it, then the motor/encoder is not connected properly. If it goes black when directly zeroed, and then turns white again after 5 seconds, then the axis limits are not connected properly. Handle so it goes black and stays black.
10. Now turn on the hand held box and set the hand held box to slow by pressing the "Slow" button and move the axis momentarily. Adjust the hand held box speed (Fast and Slow) as needed and the HHBox velocity if the speed is much too high. (Don't forget to Apply any changes you make).

    Conditional: If the axis runs off briefly and then turns off, then it usually means that the motor leads are reversed. Handle and retry.
11. Tune the motor referring to the section above on motor tuning.
12. Note the direction the axis is moving in. If it moving the wrong way, correct by changing the direction in the axis Set-up, and accepting the Set-up.
13. Next adjust the scaling: Move the axis to a known position and directly zero it there, then move it a known distance away (the further the better) and read what distance the computer thinks the motor has moved. Then adjust the display scaling per the following formula: correct display scaling = old display scaling * actual position / reported position. When this is correct, the reported position will match the measured position. To do this, you can use the scaling calculator which can be accessed by clicking on the “Calc Scale” button next to the Display Scale numeric entry box. See section above for details on use.
14. If you have target tracking software, enter the internal scaling so that the units are metres for translational movement and radians for rotational movement. Use the Display Scale Units pulldown to do the calculations for you. If you have scaled an axis in other units, then work out the relationship between your units and metres/radians and work out the internal scaling appropriately.
15. Now that the axis is scaled correctly, set up the maximum speed. This is done by putting in a move on the axis in question and running it in shorter and shorter time until the axis trips out. The move should be run with computer fairings selected in the job type display. If the computer reports that the move is too fast, then increase the axis velocity in the axis Set-up or increase the axis acceleration if it is reported to be too hard an acceleration. (This is only being done for set up purposes, normally, these values are not changed). Remember to Apply any changes in the Set-ups as you do this.
16. Now reduce the axis velocity until the computer reports that it needs more frames for the move, and the axis will actually do the move at that speed.

17. Using the move above with 25% more frames and a similar principle, set up the maximum acceleration. Use User Fairings in the Job Type display, and set the fairings on this axis to 50 up and 50 down with type 5, then run the job with shorter and shorter fairings until the axis trips out, this is the acceleration limit of your axis. Now get the computer to reject the move that the motor will not do by setting the maximum acceleration lower and lower until the computer refuses to run it. Adjust this value so that any move that has too hard an acceleration will be rejected by the computer. The maximum velocity can also be set by trying out different values in the HHBox Velocity field. Keeping increasing this amount until the axis trips out, then reduce by about 10% for safety. HHB Speed as displayed on the Hand Held Box LCD should be at maximum.
18. Set the Run Time Factor to 0.9 for safety.
19. Set up the Zeroing Style for you axis. A detailed explanation of zeroing is covered in the Zeroing Chapter of this manual, and use this to determine the correct style, and also refer to this section for error handling.
20. Set the Zeroing Velocity so that the axis moves slowly toward the selected reference point. A typical value would be between 3 and 10. (or negative)
21. Set the Zeroing Offset to 0.0, the Zero At to 0.0 and the Zeroing Time to about 20 seconds.
22. Now Home Zero the axis. If it runs out of time, just zero it again until it reaches the reference point and stops completely.
23. Now move the axis with the hand held box to the correct zero position. (This position is up to you for an axis that is not target tracking, but for target tracking axes, this position can be VERY critical, consult Mark Roberts Motion Control if you are unsure).
24. Once the axis is correctly positioned, go into the "Axis Set-up Display" and store the axis current position into the "Zero Offset" box using the mouse Store button, and Apply the changes.
25. Now zero the axis again and verify that it returns to the correct Zero position.
26. If it is desired to Zero at a position that is not 0.0, enter the desired value in the "Zero At" box.
27. Set the Zero Time to be the amount of time it takes the axis to get from its furthest position from the reference point to the reference point when you are zeroing it.
28. Save and Apply what you have done so far.
29. Set the Maximum and Minimum limits of the axis travel: Move the axis to its greatest extent of travel, and store that position into the Max Limit box using the mouse Store button. (You may have to extend the limits first). Repeat for the minimum limit by moving the axis to its most negative extent of travel. Alternatively, set these amounts to known values, i.e. if you know the tilt can go up 30 degrees and down 30 degrees, then enter 30 in the Max Limit and -30 in the Min Limit. (If these values are entered the wrong way round, then the axis will not move at all !)
30. Now set the Preroll and Postroll factors. This is done by part running the move over just the middle few frames of a move and observing the axis starting and stopping. If it starts and stops too violently, decrease the relevant factor. The optimum Preroll Factor is such that a fast move does not shake once you are into

the move, and the optimum Postroll factor slows the rig down rapidly but without mechanical strain. (Please note that in the Job Type Display, the option "Starts quickly/along path" should be set to "quickly" as should the "Stops" option.)

31. The Mimic settings are not relevant to general axis Set-up and are covered under the Mimic Chapter of this Manual.
32. If this axis has a brake on it, set the Brake flag to YES, otherwise set it to NO.
33. Set the HHB Velocity and Acceleration to values that allow you to move the axis effectively without shake and without long slow decelerations. The Jerk can also be set of this value is available to you. Start with a value of about 3 times the axis velocity and experiment until you are comfortable with it.
34. Save and Apply all the changes that you have made so far.
35. Repeat this procedure for all axes.

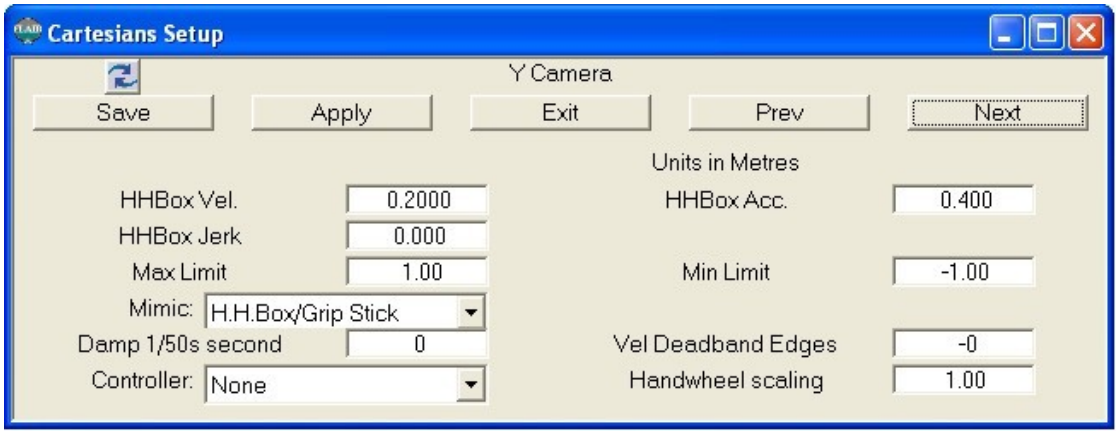
Carts Set-up

Carts set-up allows the user to define the speed, acceleration and soft limits for each Cartesian axis which are used when in Cartesian Control mode. You can also set up the mimic controller for each Cartesian axis in much the same way as you set up the mimic controller for a normal axis.

The units on the translational set-ups are in metres as that is the standard units for the Cartesians as used by the Flair system. The soft limits are then in terms of metres of travel for the linear axes. When you are in the Pan, Tilt or Roll Cartesian set-up, then the units are in degrees. The soft limits are set in the same way as with a normal axis, you can either type in a value or store the current value using the mouse store button. It is recommended that you have the rig in Cartesian control when you are doing this. Due to the complexity of the geometry in a rig, it is virtually impossible to have limits that will prevent the user from ever hitting some part of the set or floor with some part of the rig unless the limits are set so prohibitively as to restrict full use of the rig. For this reason, it is always the operator's responsibility to know exactly what the rig is doing and how close it is to parts of the set and the floor or rails and particularly any people who may be near the rig.

As of Version 4.00 the soft limits in the Cartesian Display do not function well and should be set to very wide. If the motion of an axis in Cartesian Control appears rough, you may be running into this phenomenon.

The units for the speed and acceleration are currently also in metres and degrees as applicable, with speed being in metres per second (degrees per second) and the acceleration being in metres per second per second (degrees per second per second). These values are not particularly intuitive to set, and it is recommended that you start with low values like 0.3 for the speed and 0.6 for the acceleration for the translational axes and 45 for the rotational axes, and then adjust them in small increments to find the best settings for you. The jerk is only visible if this has been set up by MRMC. This value is explained above under Axis HHB Jerk and should be set at about 3Xs the HHBox Acc.



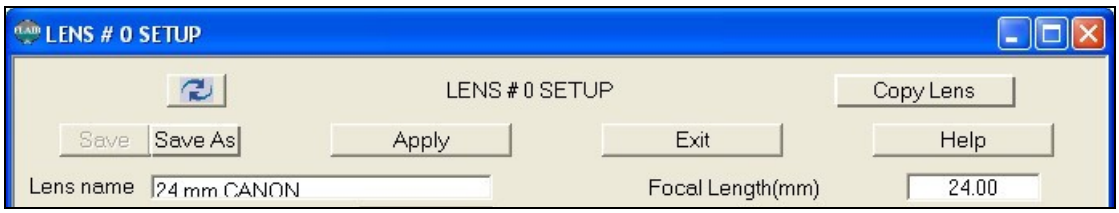
The settings for the rotational axes such as Pan, Tilt and Roll are in degrees and these values should be set to approximately 30 – 45.

Mimic Control, Damp 1/50s second, Vel Deadband, Controlling Axis, Handwheel Scaling:

Same functionality as described in Axis Set-up on page 28.

Lens Set-up

In order to set up a lens, first select "SET-UPS" on the Top Menu Bar, then "LENS SET-UP" and finally select the name of the lens you wish to modify. Once this has been done, a box will appear on the screen with the title "LENS CONFIGURATION", under that there will be 3 buttons, and below that the configurable features of the lens, most of them having a title, and an entry field. When you select “Lens Set-up” you will be presented with a list of the configured lenses on the system. The normal amount supported is 20. This may be increased through one of the advanced configuration setting discussed at the end of this manual.

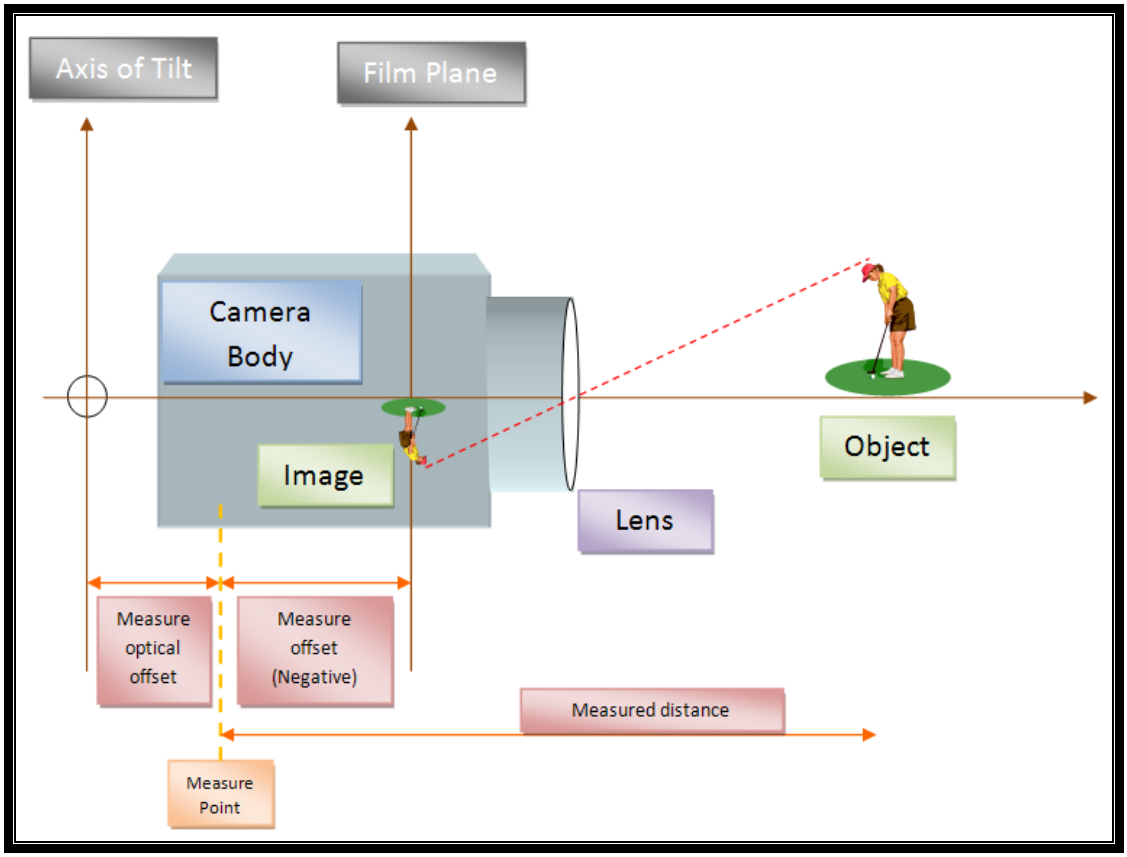


Title: The Lenses are identified by a number, and this is displayed in the title bar. If you want to make a new lens based on the setting of a previously set up lens, then clicking the mouse button over the title bar “Lens #NN Configuration” will cause the Lens Copy dialogue to appear, and here you enter the number of the lens you want to copy from and press Apply.

Note: All units except the focal length are in Metres. The focal length is in millimetres.

Lens Name: This field stores the name of the lens as a text string of up to 20 characters, e.g. "35mm Canon". Changes to this field will only be recorded if the "Save" button is pressed.

Focal Length (mm): This is the focal length of the lens in millimetres. If you are setting up a zoom lens, simply select a focal length somewhere in the range of the lens, and the software will correct for it.



The above values all concern follow focusing. The following values are for Target Tracking.

View Offset	0.000	X Nodal Offset	0.100
Y Nodal Offset	0.000	Z Nodal Offset	0.000
Meas Optical Off.	0.900	Meas Normal Off.	0.080
Snorkel?	☐	Snorkel Rolls?	☐
Customised Focus?	☑	Focus Axis Setup	Calibrate Focus
Customised Zoom?	☐	Zoom Axis Setup	Calibrate Zoom
Customised Iris?	☐	Iris Axis Setup	Calibrate Iris

View Offset: The distance from the front Nodal Point of the lens to the assumed viewpoint along the optical axis. This is usually 0.0 as the front nodal point of the lens is normally considered to be the viewpoint, however this can be changed if so desired.

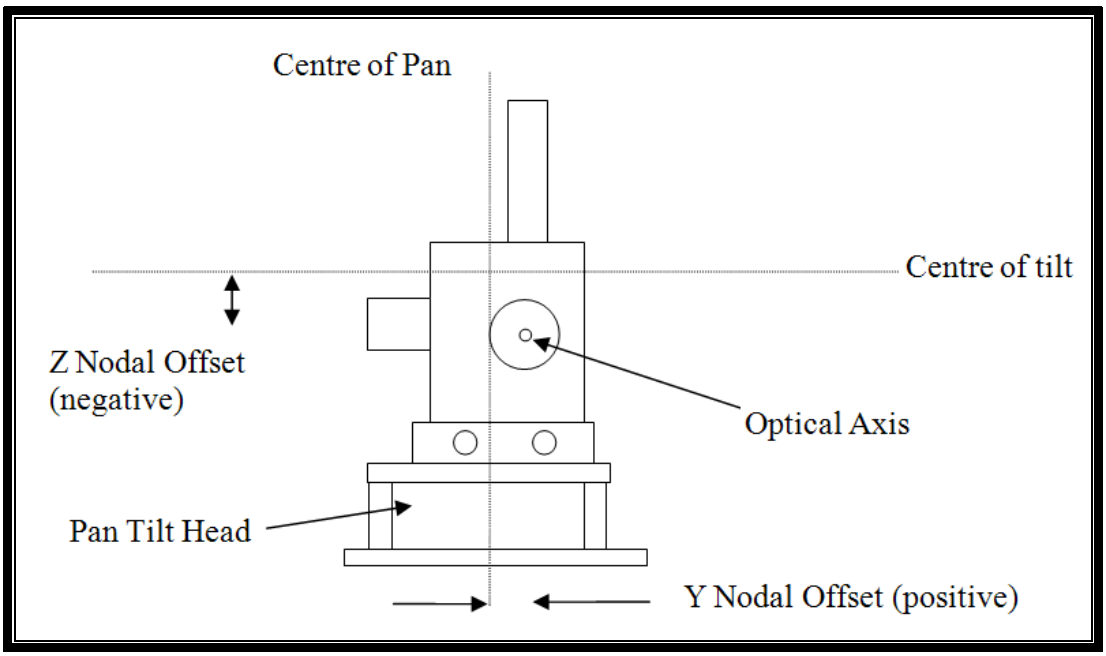
X Nodal Offset: The distance is metres measured along the optical axis between the axis of tilt and the front Nodal Point of the lens. This can be estimated by

measurement, but the exact position of the front Nodal Point of the lens may be unknown and this value is often found empirically. (See under section on setting up a lens). In the case of a snorkel lens, it is the distance from the tilt axis to the centre of the 90 degree mirror. (In this manual, a snorkel is considered to have a 90 degree mirror at the end of it. A long lens which does not have a mirror is treated as a normal lens with a large X Nodal offset e.g. borescope / endoscope). The centre of the 90 degree mirror is the point at the end of a right angle snorkel where the optical axis changes direction and is hereafter referred to as the 'Snorkel Reflecting Point'.

For a prime lens, the X Nodal Offset can safely be set to the Measure Offset + the Lens Factor with a fair degree of accuracy until you are ready for setting it exactly. The exact value of this is not vital for good Target Tracking. But it should be accurately set up for data export or move scaling

Y Nodal Offset: The sideways distance from the centre of the pan to the front Nodal Point of the lens. This can be measured as the centre of the lens is a known position. Usually the film plane and centre of the lens are on the centre of the pan rotation, but not always. This is especially true with video cameras. This measurement is positive going to the left when viewed from the rear.

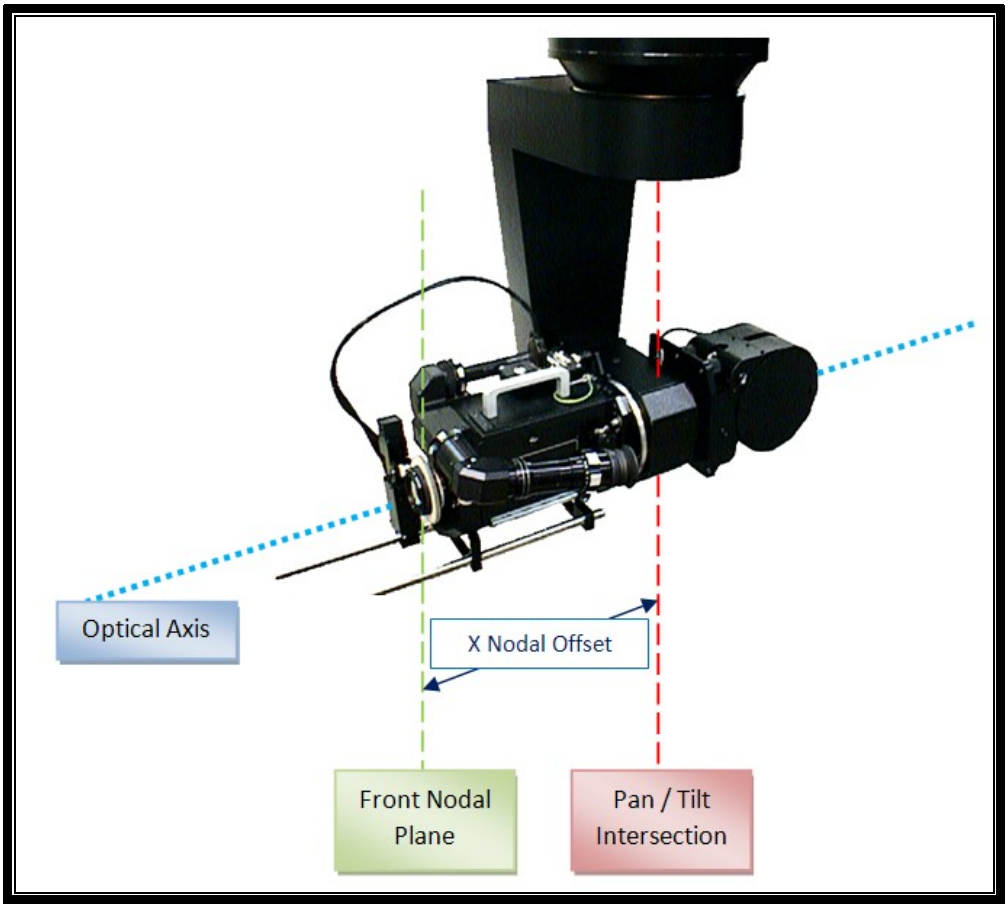
The drawing below is a view from in front of the camera of a normal geared head showing the Z and Y Nodal offsets. These are usually quite small and determining the centre of pan and the centre of tilt can be quite difficult (particularly the tilt).



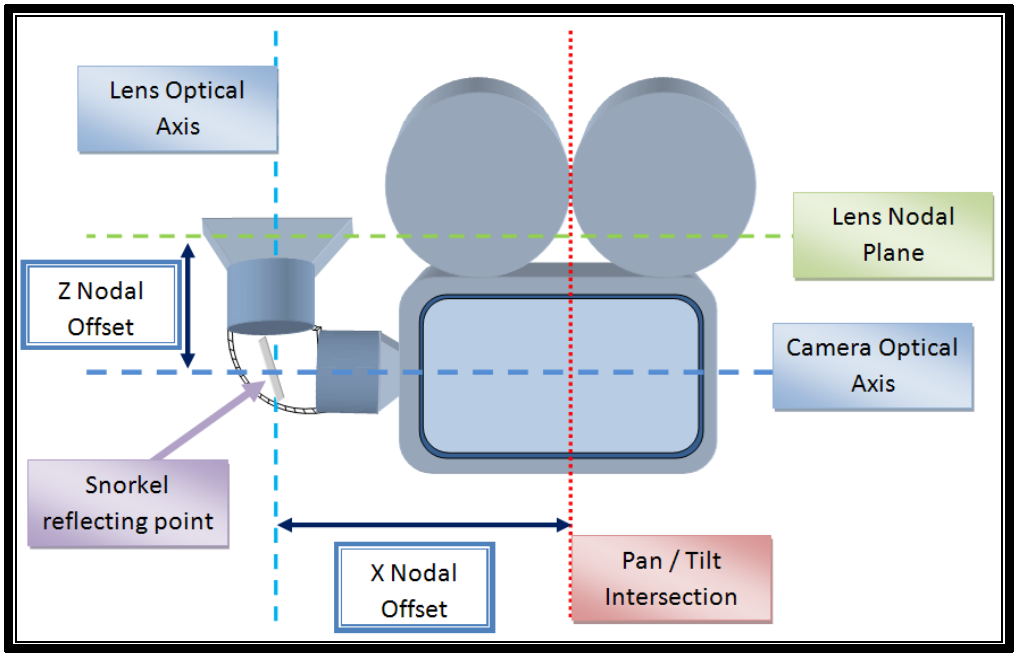
Z Nodal Offset: The vertical distance from the centre of the tilt axis and the front Nodal Point of the lens, again this distance is usually 0.0. For a snorkel lens this is from the Front Nodal Point of the lens to the Snorkel Reflecting Point. The Z Offset is measured positive going up.

The picture below is of a Mark Roberts Motion Control Slimline camera mounted on a Pan Tilt Roll head. The camera is mounted so that the optical axis of the camera is at the same height as the tilt pivot so there is no Z Offset. The Optical axis of the camera

passes through the centre of the pan so there is no Y Offset either. The Nodal point of the lens is however a small distance in front of the Pan/Tilt intersection point and thus there is an X Nodal Offset of somewhere around 0.310 Metres.

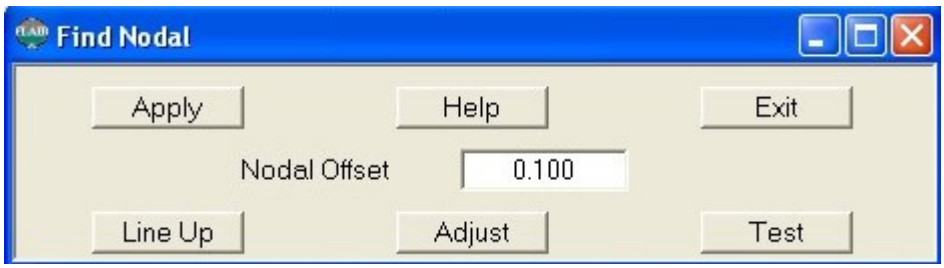


The diagram below shows a stylised drawing of a camera with a snorkel lens to illustrate how the X and Z nodal offsets are measured in this case. With a snorkel lens, the light is reflected on a mirror in the snorkel, and the location of this mirror is important. The centre point of this mirror is termed the “Snorkel Reflecting Point”.



Notes on Y&Z Nodal Offsets: You can use Y&Z Nodal offsets with a rig that has a tilting pan axis (e.g.: Cyclops, Milo, Overhead etc) but these offsets will ONLY work when you are in Keep Horizon Level or Keep Horizon Relative. If you are not in this mode, or if this mode has turned itself off, then the move will not necessarily match the programmed move. This is particularly true when you are importing XYZ data.

The X Nodal and Z Nodal Offsets each have an automatic Set-up routine that is invoked by pressing the right hand mouse button over the relevant entry box. These boxes each have a help button that explains how they operate and their operation is not further discussed here save to mention that you can change the offset while the system is in Cartesian Control without having to turn it off and then on again. This greatly speeds the Set-up time for these values. Please be aware that the accuracy of the Set-up of your rig will have a huge effect on the accuracy of these routines.



Measure Optical Offset: This is an offset used by target tracking to give the exact location of the target in space relative to the rig. It is the distance from the intersection of the pan and tilt axes to the measure point measured parallel to the optical axis. For a snorkel lens, it is the distance from the measure point to the Snorkel Reflecting Point, this measurement is in the direction of view of the lens which is at 90 degrees to the normal direction.

Measure Normal Offset: If the measure point is not close to the centre of the lens, then you tend to get an inaccuracy when measuring items which are very close to the lens. The handling for this is to tell the program how far the measure point is away

from the optical axis. (This distance is measured normal to the optical axis). If you measure with a tape that is held parallel to the optical axis, then this value should be left as 0.0.

Snorkel Yes/No: When a lens is being used on a right angle snorkel mounting, then this flag should be set to "YES", otherwise it must be "NO". A straight snorkel (borescope) is simply a normal lens with a very large X Nodal Offset. The Snorkel must point straight up when at zero, and this should be tested to ensure best accuracy.

Snorkel Locked Yes/No: If the snorkel body is locked to the tilt axis so that roll motion causes the image to roll, then this flag should be set to YES, otherwise it should be set to NO. If the snorkel Yes/No flag is set to NO, then this flag has no effect. This feature is non-functional as of version 5.00.

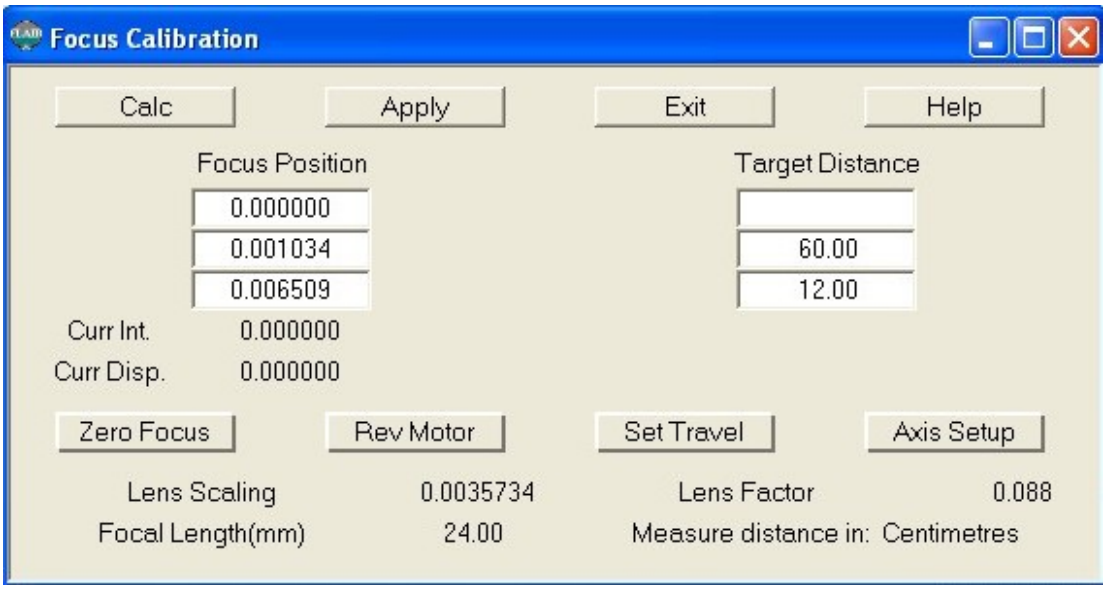
Customised Focus / Zoom / Iris: The following is described for the Focus axis but the same applies to the Zoom and Iris if they are driven by motors. If the focusing mechanism involves driving a lens through its own ring gear, then the scaling of the lens will vary from lens to lens. Due to this, a different axis Set-up is needed for each lens and also different soft limits, zeroing etc. etc. When this flag is set to YES, then if the lens is selected and the Set-up is accepted, the Axis Set-up associated with that lens is downloaded to the Focus axis so that the focusing works and the lens operates correctly. This is also true when the program loads. If the default lens has this flag selected as YES, then an Axis Set-up will automatically be downloaded to the Focus axis. If you have a slider focus mechanism on your camera, then this flag should be NO. This flag MUST be set to NO until the lens is fully set up and operational. Only set this flag to YES once the focus axis has been fully set up, and that data has been copied across into the lens Set-up.

Focus / Zoom / Iris Axis Set-up: This allows you to view and modify the axis Set-up associated with the selected lens. This Set-up is used when this lens is selected with Customised Focus set to YES. This Set-up is not changed when you are setting up a lens, the method for setting up is to use and adjust the Focus axis Set-up from the Axis Set-up pull down menu. Once the focus axis is correctly set up for a lens, then place the mouse on the FOCUS AXIS SET-UP box on the Lens Set-up Display and press the right hand mouse button. This will cause the current Focus axis Set-up to be copied into the Focus Axis Set-up for this lens, it should be accompanied by a short beep to let you know it has occurred and a message will appear. Once this has been done, then you can select Gear Driven Lens to YES, and this new Set-up will be automatically downloaded whenever you select that lens.
The above is described for the Focus axis but the same applies to the Zoom and Iris if they are driven by motors.

Calibrate: When pressed, this button causes a box to appear that allows you to automatically calibrate a lens for follow focus.

Focus Calibration

The focus calibration display consists of 4 buttons across the top (Calc, Apply, Exit & Help), a series of 6 data entry boxes for the user to enter measurements into and 3 data output displays. The Target Distance measurements are done in your selected measure units (e.g. centimetres or inches).



Focus Positions & Target Distances

Each line contains an Object Distance and a matching Focus Position when the image is sharp. The Object Distance is measured in the same units as you use in measuring Target Tracking distances (usually centimetres or inches), and the focus value is entered by using the Mouse Store Button over that box. (This is a calculated physical measurement in Metres, and depends upon the current Internal Scaling of the lens)

Lens Moves

When in Lens Moves mode (as opposed to moving camera and fixed lens), the first line MUST be an Object Distance of infinity (which is shown as a blank box), and a focus position of 0.0 and the lens has to be zeroed at infinity, the next 2 positions must be in increasing Focus Position, and decreasing Object Distance. An error message will appear if these values are entered incorrectly and you press the Calc button.

Fixed Lenses

This calibration does not currently work for a fixed lens as the Physical Scaling can be worked out exactly from the gear ratios etc. (As of version 5.00)

Current Int & Current Disp:

These output only fields are to show the user that the lens is moving and what the current internal units are and what the current display units are. This is mainly helpful to tell if the lens is moving negative which it cannot do with the current lens calibration routines.

There are a series of buttons across the screen designed to make calibrating a lens easier and quicker. These mimic the usual actions in setting up a lens. These functions rely on the focus axis being set correctly as “Focus Type” and not “Independent”.

Zero Focus:

The first step in setting up a lens is to zero the focus at Infinity. You can theoretically zero it and add an offset, but it is easier and quicker to zero at infinity.

Rev Motor:
If the motor moves negative as you move it away from infinity, the focus calibration will not work. This button automatically changes the direction of the focus motor and reverses the sign of any entered values.

Set Travel:
Set the maximum limit of the focus axis to the current motor position. Very useful for setting limits and also getting the travel of the lens for setting up a mimic controller.

Axis Set-up:
Pulls up the axis set-up dialogue box for the axis which is currently assigned to "Focus Type"

Output Data
The data displayed below these buttons is for information only and cannot be directly changed. The Focal Length is the focal length of the current lens in millimetres, the Lens Factor and the Scaling fields are the values to be calculated by the program when the Calc button is used. The Lens Factor calculated should be approximately twice the focal length in metres (e.g. for a 50mm lens, the Lens Factor should be approx. 0.1) but it can vary from a small negative value up to 0.5. The scaling MUST be positive, and is usually somewhere between 0.05 and 0.001. These are values for standard prime lenses in the range 24mm - 100mm. Lenses outside of this range, or zoom lenses may give different results.

Once the Calc button has been used, and the values produced are seen to be more or less correct (If they are wrong, they are likely to be wildly wrong and way outside the limits above), the "Apply" button can be used to utilise the values calculated, and then test them by moving the lens around in Focus Follows Object mode, and seeing that the position produced on screen is in fact a valid Object Distance.

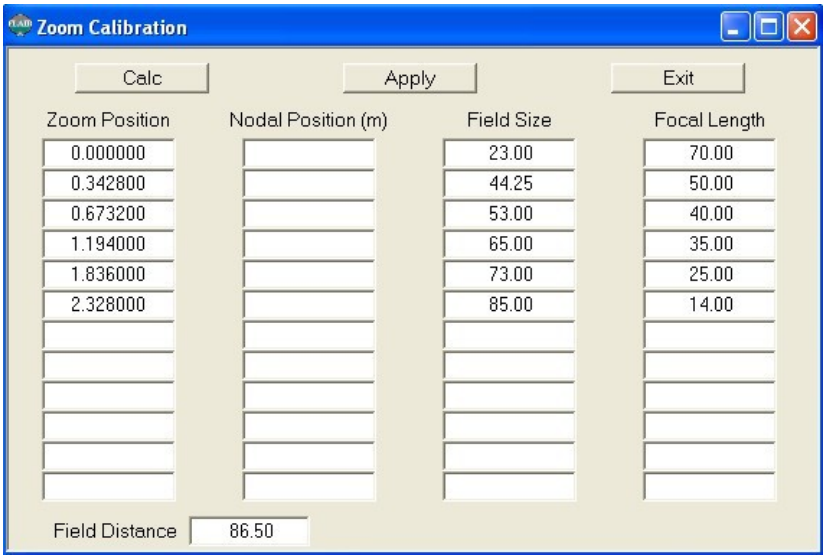
Note on calibrating lenses: It has been found empirically that MOST lenses will calibrate very accurately using the above method. Some Anamorphic lenses and some Macro (very close focus) lenses do not follow this calibration exactly, but will still operate better than by simply using the axis in an un-calibrated fashion.

Zoom Axis Set-up: This allows you to view and modify the Axis Set-up associated with the zoom motor for the selected lens. This Set-up is used when this lens is selected with Customised Zoom set to YES. This Set-up is not changed when setting up, the method for setting up is to use and adjust the Set-up for the zoom axis from the Axis Set-up pulldown menu. Once the Zoom axis is correctly set up for a lens, then place the mouse on the ZOOM AXIS SET-UP box on the Lens Set-up Display and press the right hand mouse button. This will cause the current Set-up for the zoom axis to be copied into the Zoom Axis Set-up for this lens, it should be accompanied by a short beep to let you know it has occurred and a message will appear. Once this has been done, then you can select Customised Zoom to YES, and this new Set-up will be automatically downloaded whenever you select that lens.

Linearise: When pressed, this button causes a box to appear that allows you to automatically calibrate a lens for linearised zoom.

Zoom Linearisation

The zoom linearisation display consists of 3 buttons across the top (Calc, Apply, Exit) and a series of data entry boxes for the user to enter measurements into that relate to the motion of the zoom axis. The field size and distance measurements are usually done in your selected measure units (e.g. centimetres or inches). The Nodal Position measurements must be done in metres.



Basic Principle:

By telling the computer the position of the Nodal Point, Focal Length and the size of the viewed image at different points for the zoom travel, the computer can work out for any other positions of the zoom travel, what the respective Nodal Position, Focal Length and Field Size values are. This means that you can plot a move on the zoom axis in terms of field size, and the zoom will be driven to change the field size in a smooth manner. Normally the field size change does not move at all steadily with a constant movement on the zoom lens. The feature makes it easier to do contra zooms (zoom in and track back to change perspective without apparent change in object size) and also makes it easier to match the end of one zoom to the beginning of another.

Field Distance:

In order to work out a field of view or a focal length given a field size, the computer must know at what distance the field size is being measured. This distance is referred to as the "field distance" for want of a better term. When one is setting up a zoom lens in this manner, it is quite usual to ignore the movement of the nodal point in working out the zoom angle calculations. In this case the field distance must be as large as is feasible. It is best also to leave the focus as close to infinity as possible when doing these measurements. I would try not to use a field distance of less than about 30' if I had a 10x zoom or greater.

Field Size/Focal Lengths:

A zoom lens can be linearised by entering the field sizes against the motor position or the focal lengths against the motor positions. In the case of a Zoom Lens that has good calibration marks on its barrel, it is often easier to use the marked focal lengths. If you

are doing some very critical work, it may be more accurate to use the field sizes method.

Zoom Positions, Nodal Positions, Field Size & Focal Lengths:

Each line contains a Zoom Motor Position, at each of the points, the user can enter the position of the Nodal Point, the focal length or field size at a specified distance. The actual units of the field size do not matter that much, but the stated "Field Distance" must be in the same units. As of version 5.00, the position of the nodal point is NOT used and this column is best left blank. To blank out all the entries in the column, click the middle mouse button on the label at the top of the column.

Once these figures are all entered, press the "Calc" button, and the computer will fit curves to the entered points. If you have entered only field sizes, this curve will be used for zoom linearisation, if you have entered only focal lengths, then the corresponding curve will be used. You may fill in either column or both columns and observe the results. It is a good idea to test any lens you are not familiar with before using it.

If the Linearise calculation fails, there will normally be an error message, but the cause is usually a change of direction in one of the relevant table, otherwise these linearisation curves can be "applied" to the current lens. Once that has been done, when that lens is accepted, these newly worked out curves for linearising the zoom will be put into effect. If the lens "Save" button is used, then the zoom positions, focal lengths and field sizes that you entered will be saved onto disk, and may be viewed whenever that lens is selected.

Once all the above has been done, you can view and use the fruits of your labours by going into the "Job Type Display" and setting the Zoom lens from "Zoom is Independent" to "Zoom is linearised", "Zoom is in focal length" or "Zoom is in view angle". In the last 2 of these, the actual zoom axis will read as focal lengths or as a view angle and can be programmed as such. The mode of each axis of the sort (Focus, Zoom, Iris etc) may also be changed by using the axis right click pull down menu.
Note that the actual view angle and focal length may not match what the lens says. This may be due to the method you used to measure the field size. This will not adversely affect the linearisation, but if you want to correct this, you should contact Mark Roberts Motion Control and ask for assistance.

Iris Axis Set-up:

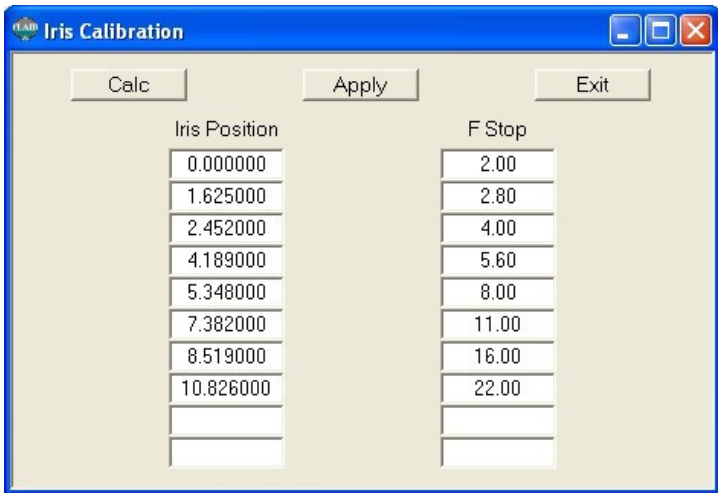
This allows you to view and modify the axis Set-up associated with the iris motor for the selected lens. This Set-up is used when this lens is selected with Customised Iris set to YES. This Set-up is not changed when setting up, the method for setting up is to use and adjust the Set-up for the iris axis from the Axis Set-up pull down menu. Once the Iris axis is correctly set up for a lens, then place the mouse on the IRIS AXIS SET-UP box in the Lens Set-up Display and press the right hand mouse button. This will cause the current Set-up for the iris axis to be copied into the Iris Axis Set-up for this lens, it should be accompanied by a short beep to let you know it has occurred and a message will appear. Once this has been done, then you can select Customised Iris to YES, save the Set-up and the new Set-up will be automatically downloaded whenever you select that lens.

You must have one and only one axis selected as "Iris Type" in its axis Set-up.

Calibrate: When pressed, this button causes a box to appear that allows you to automatically calibrate an iris ring so that it can be read in stops.

Iris Calibration

Iris calibration is done through entering up to 10 stops and motor positions. The computer will then fit a curve to the entered points and use this curve to convert motor positions to stops and vice versa. The points are entered as per normal, simply decide where the iris is to zero, and zero it; then move the iris by hand through each of its marked stops, entering the stop on the right and using the mouse store button to read the iris axis position into the column on the left. The positions must not reverse direction nor can the stops, but otherwise they can be increasing or decreasing. The scaling of the iris axis is not important, but I would recommend something that gives you a number from 5 - 50 for the full travel of the iris and make sure that the internal and display scales are exactly the same. If you do not have enough stops marked on the lens to fill the whole table, then blank out any unused fields. If you have more stops on the lens than positions, then make sure that you calibrate to the extremes, and leave out one or more points in the middle, as outside of the calibrated range, the results are not going to be entirely accurate.



Once all the needed points are correctly entered, you can click on the calibrate button and you should get a message “Iris splined OK” If there are any problems, the computer should inform you of exactly what is wrong. It is also a good idea to enter the soft limits for the iris at this time to make sure that you do not go outside of the calibrated range. Once all is set up and the axis speeds etc. have been verified as OK, it is a good idea to copy the Set-ups for the iris axis into the lens iris axis Set-ups to ensure that when this lens is next selected, the calibration data and soft limits are not lost. This is done in much the same way as with a focus calibration, click the mouse store button over the “Iris Axis Set-up” button and the Set-up for the iris axis will be read into the lens Set-up ready for use. Next select “Customised Iris “to “Yes” and whenever that lens is selected, the data will be transferred to the iris axis to set the limits correctly.

Setting up a Gear Driven Lens

(CAPITALS indicate a button name)

This involves changing values in the Lens Set-up for that lens and the Axis Set-up for the Focus axis. Note that there are 2 Focus Axis Set-ups. One is called the Focus Axis Set-up and is the Set-up associated with the focus axis as it runs now. The other is called the Lens Focus Axis Set-up and is the Set-up that is applied to the Focus axis when that particular lens is used. These displays look identical except that in the Focus Axis Set-up the axis name is usually "Focus" and in the Lens Focus Axis Set-up, the name is the same as the lens'. All measurements in the Lens Set-up Display except for the focal length are in metres.

0. In the Focus Axis Set-up make sure the Focus axis is selected as a FOCUS TYPE.
1. Go into the Lens Set-up Display for the lens you are setting up.
    a. Type the name of the lens into the Lens Name field and press the enter key.
2. Enter the Lens Focal length in millimetres.
3. Enter the Infinity Offset as 0.
4. Enter the Measure offset as 0. (Lens are usually calibrated to the film plane)
5. Set all other offsets to 0.
6. Select "Customised Focus" NO and APPLY lens Set-up. (Once the Set-up is finished, this will be changed to YES, but not during the Set-up.)
7. Go into AXIS SET-UP for the FOCUS axis and select an internal scaling, about 0.005 is a good starting point. Set the maximum and minimum limits very large to facilitate setting up the lens (+200 and -200 for e.g.).
8. Move the lens to infinity focus and DIRECT ZERO the lens there using the Zeroing pulldown menu on the Top Menu Bar.
9. Move the lens through about 1/2 of its travel, making sure that the current position reads as a positive number. If it reads negative, then the axis direction is wrong and must be changed in the focus axis Set-up to correct this.
10. In the LENS SET-UP box for that lens, press the CALIBRATE button. A box will appear as described above.
11. Enter the object distance at which the lens is now focused into the second Object Distance box (leave the first one as infinity) and store the current focus axis position into the second Focus Position box using the Mouse Store Button (right hand button). The object distance is entered in your standard measure units, usually centimetres or inches (the focus axis does not need to be engaged to do this).
12. Now move the lens to the closest focus position being careful not to exceed its travel.
13. Enter the Object Distance and Focus Positions into their respective last boxes and press the Calc button in the Lens Calibration Display. Check the calculated scaling and lens factor to see that the scaling is small and positive, and the lens factor is small and somewhere in the range -0.1 to 0.5. If either value is outside of this range, check that the points have been entered correctly, and check that the focal length is entered correctly.

14. Now use the Apply button to put these values into use, and use the Cancel button to remove the Lens Calibration Display.
15. Apply the Lens Set-up and in the Job Type display, switch the lens on to "Focus Follows Object" and run the lens back and forth and verify that throughout its range, the distance calculated by the computer and displayed above the Focus Axis Header button on the main display matches the distance from the film plane to the object.
16. If your measure hook that you will usually measure from is not at the film plane, then enter the distance from the film plane to your measure hook measured in metres into the Measure Offset in the Lens Set-up Display. Save and Apply the Set-up.
17. In the JOB TYPE display, switch the focus control back to Independent.
18. Select a zero point for the lens at a known fixed point. Infinity is recommended as most lenses have this clearly marked.
19. Set up the lens to zero in this position using your preferred method (see Chapter on zeroing). Then zero it there.
20. Move the lens from its zero position to infinity focus, then go into the Lens Set-up Display and store the focus axis position into the infinity offset by pressing the mouse store button with the cursor over this box.
21. The rest of the focus axis parameters should then be set up by following the standard axis Set-up procedure, including maximum speeds and limits of travel.
22. Once all is set up, copy the data from the Focus Axis Set-up into the Lens Focus Axis Set-up so that it is permanently recorded with this lens data. This step is very important to do correctly so that you don't have to set up the lens each time you use it. To do this, Apply the Focus Axis Set-up if not already done, go into the Lens Set-up for that lens. Place the mouse cursor over the button labelled "Focus Axis Set-up" and using the mouse store button, read the data from the Focus Axis Set-up into this Lens Focus Axis Set-up. If this works, you will hear a short beep, and a message will appear. If you then press the "Focus Axis Set-up" button, you will enter the Lens Focus Axis Set-up for that lens, and the values should be the same and the ones you just set up for the Focus Axis. Once this is done, you may set the "Customised Focus" switch to YES.
23. Now set up the X Nodal Offset. The value should be set to the distance from the tilt axis to the film plane plus the lens factor less the focal length (in metres). It can be found more precisely using Cartesian Control, but is not explained in this section. A good rough estimate for a prime lens is the distance from the tilt axis to the front glass element of the lens.
24. Enter in the Z and Y Nodal offsets as measured from the intersection of the pan and tilt axes. The Y offset is positive going to the left (looking from the back of the camera) and the Z offset is positive going up.
25. The View Offset is the distance from the nodal point to the assumed view position. This is normally at 0 to put the viewpoint on the front nodal point, but can be adjusted to change the look of the move.
26. The last 2 fields in the Lens Set-up now need to be set, these are for Target Tracking purposes, and do not affect the operation of Follow Focus, but are important for accurate Target Tracking, Scaling and XYZ Data output. The

Measure Optical Offset is the distance from the intersection of the pan and tilt axes to the measure hook measured in metres parallel to the optical axis. The Measure Normal Offset is the distance from the measure hook to the Optical Axis measured perpendicular (normal) to the Optical Axis.

27. These values give a very accurate positioning of the target when in target tracking and this is required for scaling and other advanced features.
28. SAVE and APPLY these settings.
29. Whenever this lens is selected again, the settings you have just adjusted will be used by the system to accurately pull focus.

CONDITIONAL: More accurate setting up of the X Nodal Offset can be done by putting in a target tracking move such that the camera pans around an object (just a track and pan with an object beside the rails). If the distance to the target is correctly measured at each end of the move, and the rest of the rig is correctly set up, then the target should be stationary on the Targets display. If it is not, then adjust the X Offset until it is. Alternatively, this value can be set up by using Cartesian Control - This is a specialised program feature and is covered in the target tracking section of this manual, contact MRMC for more details.

Setting up a Non Gear Driven Lens

When you have a focusing mechanism that is directly driven unlike a Gear Driven Lens, the scaling is the same for each lens, and only needs to be measured once.

0. Make sure the focus axis is selected as a FOCUS TYPE.
1. Enter the Lens Focal length in Millimetres and enter the lens name into the Lens Name field making sure you press the “Enter” key when you are done.
2. Enter the Infinity Offset as 0.
3. Enter the Measure offset as 0. (Lens are usually calibrated to the film plane)
4. Set all other offsets to 0.
5. Select "Customised Focus" NO and APPLY lens Set-up.
6. Go into AXIS SET-UP for the FOCUS axis and set the internal scaling per the mechanics of the lens drive mechanism. This must scale to metres, and it is vital that this value is correct. Set the display scale to 1000 X this value.
7. DIRECT ZERO the lens at Infinity focus.
8. Locate an object at a close distance from the lens, and pull focus on this object.
9. In the JOB TYPE display select FOLLOW TARGET or FOLLOW OBJECT.
10. A target distance will be calculated by the computer and will appear in the focus axis "Current Position" box. Compare this distance to the actual target distance, and set the LENS FACTOR to the difference between them. Verify that the reported target distance is now correct.
11. Check the focus at various distances.

12. Once it is correct, you may want to set the lens up to not zero at infinity. In this case, set up the zeroing to where you want it to go and zero the lens, then move it to Infinity, and using the right hand mouse button over the Infinity Offset box in the lens Set-up display, store this distance as the Infinity Offset.
13. Once the zeroing is set up, the soft limits for the focus axis can be adjusted, in the standard focus axis Set-up.
14. Once all is set up, copy the data from the Focus Axis Set-up into the Lens Focus Axis Set-up so that it is permanently recorded with this lens data. This step is very important to do correctly so that you don't have to set up the lens each time you use it. To do this, Apply the Focus Axis Set-up if not already done, go into the Lens Set-up for that lens. Place the mouse cursor over the button labelled "Focus Axis Set-up" and using the mouse store button, read the data from the Focus Axis Set-up into this Lens Focus Axis Set-up. If this works, you will hear a short beep, and a message will appear. If you then press the "Focus Axis Set-up" button, you will enter the Lens Focus Axis Set-up for that lens, and the values should be the same and the ones you just set up for the Focus Axis. Do not select “Customised Focus”.
15. Now set up the X Nodal Offset. The value to start with should be set to the distance from the tilt axis to the film plane plus the lens factor less the focal length (in metres). It can be found more precisely using Cartesian Control, but is not explained in this section. A good rough estimate for a prime lens is the distance from the tilt axis to the front glass element of the lens.
16. Enter in the Z and Y Nodal offsets as measured from the intersection of the pan and tilt axes. The Y offset is positive going to the left (looking from the back of the camera) and the Z offset is positive going up.
17. The View Offset is the distance from the nodal point to the assumed view position. This is normally at 0 to put the viewpoint on the front nodal point, but can be adjusted to change the look of the move.
18. The last 2 fields in the Lens Set-up now need to be set, these are for Target Tracking purposes, and do not affect the operation of Follow Focus, but are important for accurate Target Tracking, Scaling and XYZ Data output. The Measure Optical Offset is the distance from the intersection of the pan and tilt axes to the measure hook measured in metres parallel to the optical axis. The Measure Normal Offset is the distance from the measure hook to the Optical Axis measured perpendicular (normal) to the Optical Axis.

    These values give a very accurate positioning of the target when in target tracking and this is required for scaling and other advanced features.
19. Save and Apply these changes.

Animation Stand:

Most motion control systems use a camera mounted on a crane type system. But the Flair software also supports Animation Stand focussing. If your system has been set-up for this, a slightly smaller lens set-up will appear which is missing much of the exact nodal point set-up that you would find on a Motion Control crane.

Animation Stand Focusing: A different value is needed for an Animation stand to be able to focus on the table throughout a move. The infinity offset is simply the distance from the lens zero point to infinity focus. However with an animation stand, normally the lens is on a slide, and the exact infinity focus position is not known. In addition, the software has to know exactly how far the camera is from the table. This cannot easily be measured as measuring from the precise position of the film plane can be difficult. However, there is a set-up routine which is covered below under Animation Table Calibration, and if you have this then you should proceed to that section now.

The following applies to motion control systems that are not animation stands:

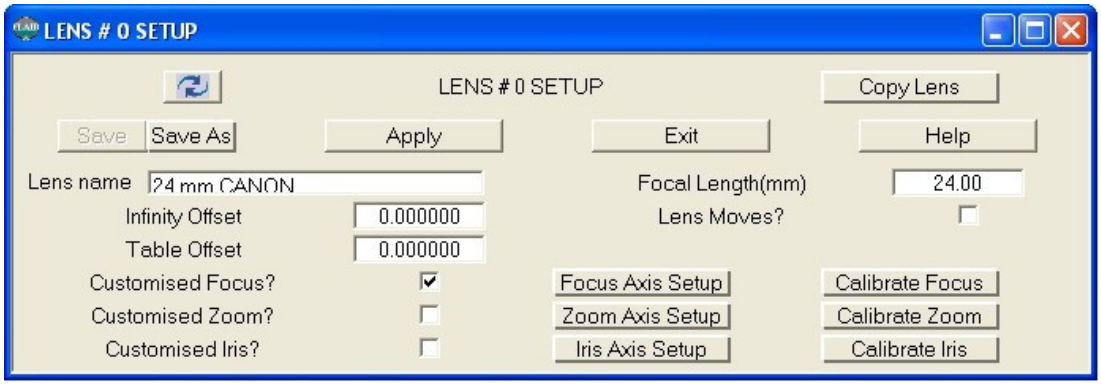
Infinity Offset: The distance from the zero position of the lens to the point where the lens focuses on infinity. This allows the lens to be zeroed wherever is most convenient to the user. The value is stored in this box by zeroing the lens, moving it to infinity focus, and then pressing the right hand mouse button when the cursor is on this box. It is strongly recommended that you zero the lens at infinity focus. Normally “0.0”.

Lens Moves: If the nodal point of the lens moves when you pull focus, then this flag should be set to YES. This is true of the majority of lenses. In some cases, the body of the camera is moved to focus, in that case the flag should be set to NO.

Measure Offset: For film lenses this is the distance in metres from the film plane to the point from where you measure. It is recommended that this is left as zero and that you measure from the film plane if this is at all possible as it simplifies things. For many Video lenses, the numbers marked on the lens do not measure the distance from the chip to the target, but from near the front of the lens to the target. With these lenses it is easiest to set the measure offset to 0.0 and measure from the front of the lens.

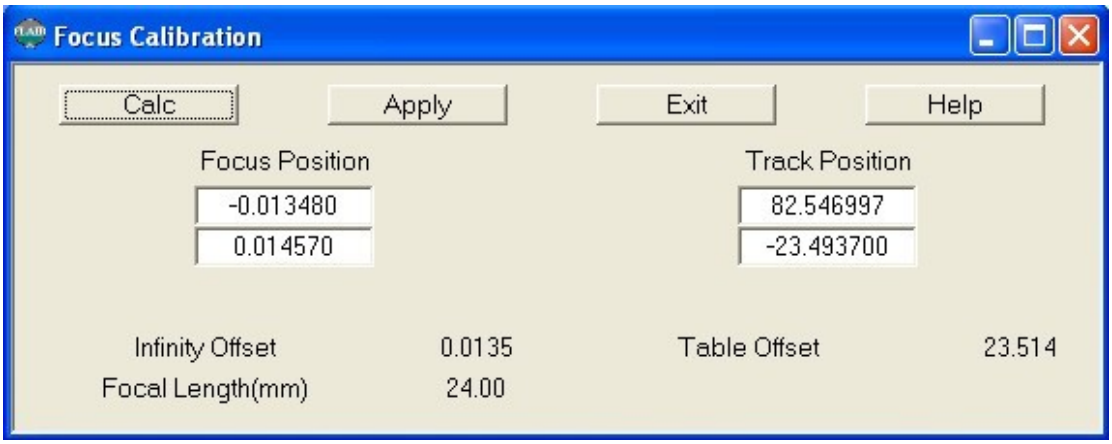
Lens Factor: This is the "thickness" of the lens and is the distance from the front focal point to the rear focal point of the lens. It is found empirically, but is usually about twice the focal length of the lens (in metres). See section below on lens calibration for determination of this value.

In Animation stands the camera is mounted on a carriage that moves up and down above a flat table. These have specific requirements in terms of focusing. When the system is identified as having this form of table focusing, then the lens Set-up display will appear in a slightly cut down version. There are no X,Y and Z nodal offsets, and there is a new "Table Offset". The principle with this system is that the computer needs to know how far the lens is from infinity focus when it is zeroed (infinity offset) and how far from the table the front focal point of the lens is when the camera is at its zero position and the lens is at infinity focus (table offset). These 2 values are all that is needed (with the focal length and lens scaling) to make auto focus work.



The scaling for the lens is worked out by moving the lens on its slider or by working out the gear ratios etc. It is crucial that this value is correct especially if you are going to go through 1:1. This will normally be done by Mark Roberts Motion Control. If the lens is actually fixed to the carriage and the camera moves away from the lens, then this value is worked out the same way, but the "Lens moves" flag must be switched to "No". The scaling must be done so that the physical scaling is in metres and positive motion moves the lens away from the camera. The track axis must also be scaled so that its motion is positive upwards and is in metres. Also note that the focus axis must be assigned to "Focus Type" and the kinematics set up must be completed for this to work (see later section on Table Kinematics).

Calibration of these 2 unknown values (infinity offset and table offset) has been automated and is relatively simple. Press the "Calibrate" button and the Lens calibration dialogue as shown below will appear. Move the Camera to near the top of the column and then move the lens until the image is sharp. Store the Track position into the top right hand entry box using the mouse store button and store the focus axis position in to the top left hand entry box again using the mouse store button. Then move the lens out to its furthest limit, and track the camera down until the image is sharp, this could well be through 1:1, it depends on the lens and amount of travel on the lens slider. When this has been done, store the relevant positions into the second line and press the "Calc" button. This will cause the Table Offset and Infinity Offset to be calculated. Once applied, these values should allow the user to switch the "Auto Focus" switch on the control menu bar to "Auto Focus On", a small Goto may result and then as the camera is moved up and down, the lens should move to keep the image sharp.



Focus Positions & Track Positions
Each line contains a Focus Position and a matching Track position when the image is sharp. The units are in the normal physical units of the axis, and are simply stored in rather than typed, using the Mouse Store Button (Right hand button)

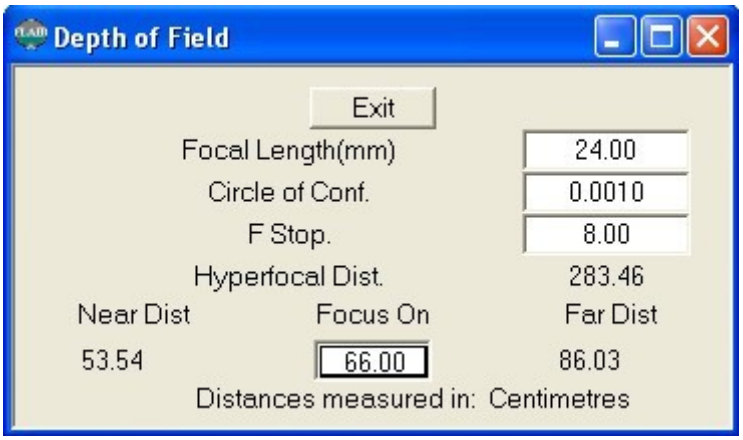
Output Data:

The data displayed below the Focus Positions and Track Positions is for information only and cannot be directly changed. The Focal Length is the focal length of the current lens in millimetres; the Infinity Offset and the Track Offset are the values to be calculated by the program when the Calc button is used. The Table Offset is the exact height of the focal plane above the table when the track is at zero. The Infinity Offset is the distance from the focus zero position to infinity focus.

It has been found that the exact focal length of the lens is crucial to accurate focusing especially when you get close or through 1:1. Even the focal length stamped on the lens can be off by a few percent. If you find that the image is sharp at near and far focus, but soft in the middle then the focal length is possibly wrong or the scaling of the track or focus axis is wrong. If the problem is not the scalings then it is most likely that the focal length of the lens is wrong. Move the camera in autofocus to the point where the image is the most soft. Turn off auto focus and in the lens Set-up adjust the focal length by a small amount (1% or so), go back into the Lens Calibration display and press the "Calc" and "Apply" buttons again. (You do not need to go to close and far focus again as these positions have been recorded with a sharp image and so their data is still valid). When this has been done, switch into auto focus again and see if the image is sharper or softer. If it is softer, adjust the focal length in the opposite direction. If it is sharper, follow the above procedure until the image is fully sharp throughout the range of motion of the camera.

The "Customised Focus" switch is not valid with this form of focusing and should be left in the "Off" state and there is usually no need to adjust any of the axis settings for each lens. You will find however that the soft limits and hand held box speeds on the lens are very important when you are in auto focus as the speed with which the camera approaches the table is firstly limited by the maximum speed of the carriage and as you get closer, it is limited by the maximum speed of the lens. Therefore the maximum speed of the lens and its maximum acceleration as well as maximum limit must be set up properly.

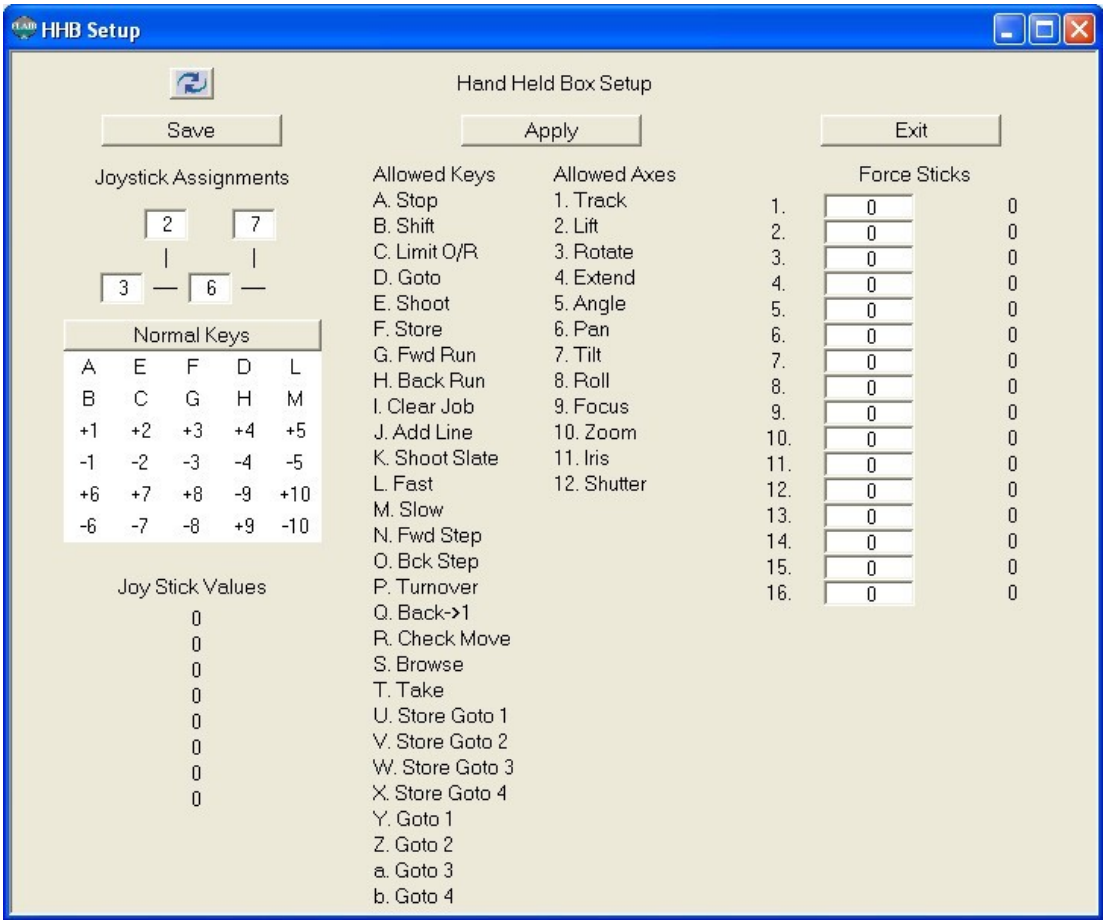
Depth of Field Calculator



A Depth of Field calculator is provided for the user when the "Target" button on the Numeric display is pressed. This calculator works out the depth of field following one of the accepted formulae and uses the settings as shown in the calculator display. The user is free to adjust the Circle of Confusion (in 1000ths of an inch) or the F-stop if it is not computer controlled. A hyper-focal distance is shown as well as near and far focus distances in the currently set target distance. The hyper-focal distance will always present a read out, but the near and far focal distances will only be displayed if the focus is set up and in "Focus Follows Target" or "Focus Follows Object" mode. This calculator is intended as a guide only and you should test out its reliability before relying on it. Different people have different ideas about depth of field and also different formulae give quite different answers, as well as some lenses being unusually weighted in terms of what is in focus behind and in front of the nominal focus distance. The near and far focus distances should be continuously updated as you move the focus around, and also as you move the iris, if the iris is motorised and properly calibrated.

Hand Held Box Set-up

The hand held box is turned off while this set-up is displayed so that buttons can be tested etc. without risk of moving the rig. Pressed buttons will turn red and the joystick values should be displayed as they change.



Joysticks

The joysticks can be assigned to any axis that you wish simply by selecting the relevant box and typing in the axis's number. If the joystick moves the axis in the wrong direction, simply change the sign of the axis number by entering a negative number. If an axis is assigned to a joystick, it will not then move on a button, even if one is assigned to it.

Keys

There are 2 sets of 30 keys laid out in six rows of five keys. One set is the "Normal Keys" and the second set is the "Shift Keys". The Normal Keys operate when the shift key is up and the Shift keys operate when the shift key is down. Any key can either be a motion key or a function key. A list of the available functions and axes is given on the display on the right hand side. Function keys are designated by letters and motion keys are designated by numbers followed by a "+" or a "-" (The "+" is assumed by default and does not need to be typed in). There are 3 specialised functions keys which are "Stop" "Shift" and "Limit O/R" These keys must be assigned to the same key position in both the Normal Keys and the Shift Keys layout. The Limit O/R key allows you to override the soft limits on an axis for manual movements and is only active while the button is depressed. When you are in Shift Mode, an "S" is displayed on the HHBox LCD and when you are in Limit Override mode, an "O" is displayed.

Function Keys

If you want to assign a function key, find the designation letter by looking at the list down the right hand side of the display, then choose the key that you want to do that function, select that key with the mouse select button, and then type the relevant letter

on the Qwerty keyboard, then use the "Enter" key on the Qwerty keyboard to enter the data. If there is any other key also assigned to this function, it must be removed by selecting that key, and then deleting the assignment by using the backspace delete key.

Motion keys

The keys can also be used to move axes. The keys are assigned to an axis in the same manner as the joysticks are. Get the axis number from the list on the right hand side of the display, select the key you want to assign, and type in the axis number, followed by a "-" if you want it to move the axis backwards, and then type "Enter" on the Qwerty keyboard to enter the data. There is a difference with motion keys as opposed to the joysticks as you have to assign a positive direction key as well as a negative whereas the joysticks automatically handle both directions.

Grip-Sticks

The Grip-Sticks settings allow you to allocate up to 16 Grip-Sticks to any of the motion axes. The number of Grip-Sticks that you can have depends on the number of Grip-Stick connections boxes you have purchased. The minimum is 4. The assignment of the axis is done in the same way as a motion key or joystick, a positive number indicates the axis to be controlled, a negative number is the same axis with the direction reversed. The number displayed to the right of the Grip-Stick allocation box is the current reading from that Grip-Stick. It is a good idea to push and pull on the stick to make sure that you have identified the correct stick and direction before you assign it to an axis. Occasionally you may find that an axis controlled by a Grip-Stick starts to drift. In this case, increase the deadband in the Grip-Stick Set-ups or simply turn the Hand Held Box Off and then On again as this will re-zero the Grip-Sticks. (Do not turn the Hand Held box on when someone is applying force to any of the Grip-Sticks).

Grip-Stick Safety

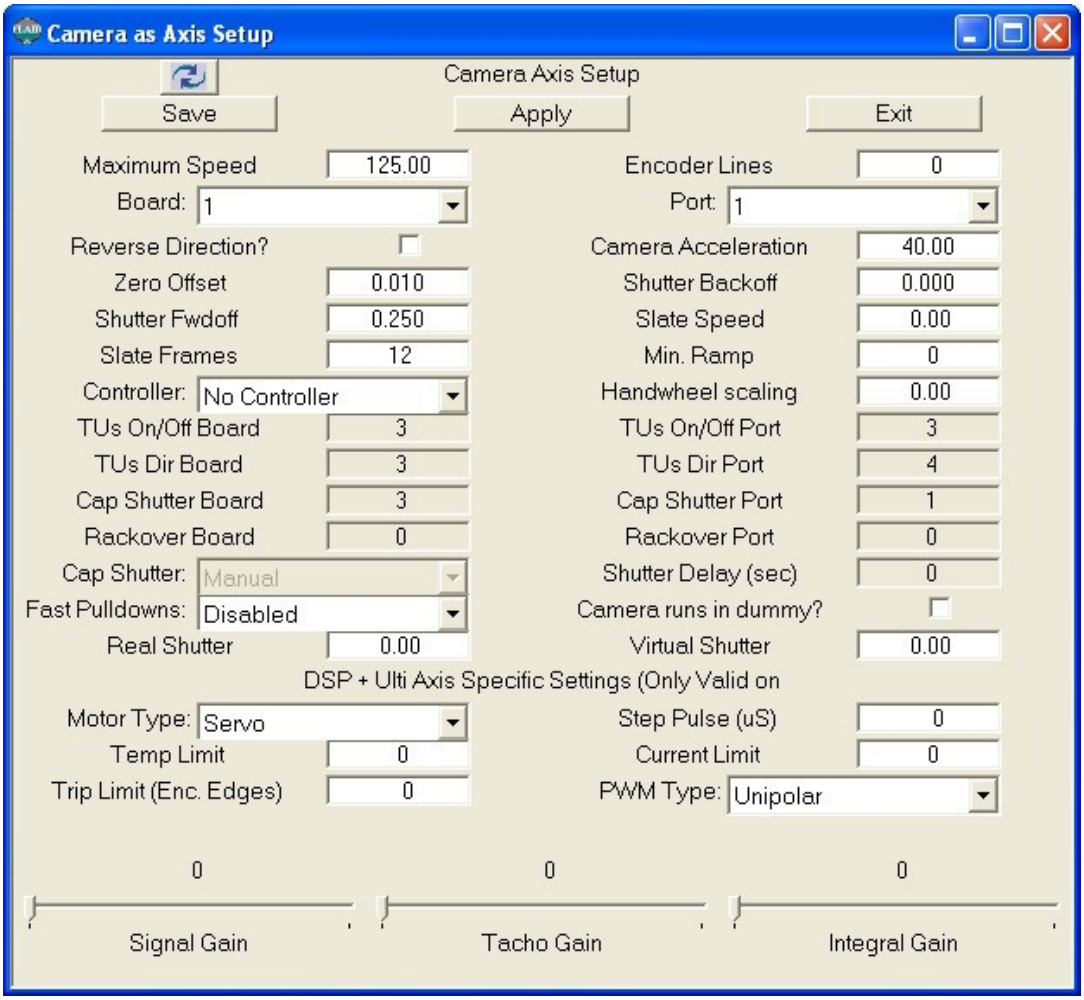
Grip-Sticks should always be used with extreme caution, as they give the user the full power of a motion control rig, even though he is applying very little force. One can easily crush metal without realising it or even feeling the force required to do that. Additionally Grip-Sticks are very sensitive pieces of electronics and therefore should be treated with care to make sure the sensors or cables don’t get damaged. Use the following golden rules:

- Always have someone near the emergency stop when using Grip-Sticks.
- Don’t plug or unplug the Grip-Sticks while they are enabled in the software.
- Always set the end limits, of travel, correctly for the axis you are controlling in the software.
- Never leave Grip-Sticks unattended and enabled.

When not using them, even for a short time, it is best to disable them.

Camera Axis Set-up

The Camera Axis setup only applies to film cameras where Flair has direct control of over the film transport motor. For other cameras, including most film cameras and video cameras see the section on External Camera Set-up.



Maximum Speed: The maximum speed of the camera in frames per second is entered here to prevent the camera being run too fast in a move. This speed depends on your camera and on how fast you want it to run, animation cameras typically should not be run at speeds higher than about 12 FPS, while most Mitchells will go up to 120 FPS. This maximum is also used to scale the variable camera speed graph. (It can be useful to lower this value to make the graph scale in a more usable range)

Encoder Lines: The number of encoder lines per frame is entered here, usually this is the number of lines on the encoder, but it also depends on the gearing if it is not direct. Contact Mark Roberts Motion Control if there are any problems. Note that this MUST be a whole number, if your camera is geared so that it isn't, then the gearing must be changed.

Board Number: Board number to which the camera is assigned. (Not counting the mimic board if there is one).

Port Number: Port number on the board to which the camera is assigned. (Valid values are 1-4 inclusive)

Camera Direction: This allows the camera's direction to be swapped much like an axis. If when you run the camera forwards, it actually goes backwards, then this simply need to be changed.

Camera Acceleration: The acceleration of the camera is entered here in Frames per second per second. It governs how rapidly the camera will ramp up to speed. It also determines the highest single framing speed. The values can be set as high as the mechanics of the camera and the motor drive will allow. This value affects the number of frames required to get the camera up to speed. For a Mitchell high-speed camera, the value has been found to be about 40.0. This means that it will single frame at 4.0 FPS and will get up to live action speed in about 10 frames of film.

Zero Offset: The signed fraction of a frame between the encoder zero marker pulse and the correct zero position for the camera. This would normally be set up once at installation time, and not changed. When the camera axis is engaged it automatically zeros itself by seeking in wider and wider arcs for a zero marker pulse on the encoder. Once it finds the zero marker pulse, the camera comes to rest at Zero Offset away from the marker pulse. To set this value up, first set it to 0.0 and engage the camera. The camera will do a seek and stop on the encoder zero marker pulse. If this is not within 1/8 of a turn of the correct zero position, then the motor or encoder should be turned until it is, as this will prevent film exposure during Zeroing. Then disable the motor and turn it to the correct zero position. Place the mouse cursor over the "zero offset" box and click the right hand (store) button. The amount you have moved the camera will then be stored into this box. Save and Apply the changes and re-engage the camera, then check that it zeros correctly.

Shutter Backoff: The fraction of a frame that the camera can safely turn backwards without exposing the previous frame. This is used to allow a higher single framing speed. The camera must be able to move forwards and backwards by this amount either side of the zero position without any adverse effects. Most cameras allow about 1/8 of a turn = 0.125. This value should be left at 0.0 as it is not fully implemented as of version 4.00

Shutter Fwdoff: The fraction of a frame that the camera can safely turn forwards without exposing the next frame. This is used to ramp that camera up to speed when you are single framing. The camera will not be up to speed until this far through the frame. In most cases, this value can be set to 0.25. Too low a value here will prevent single framing. You should be able to single frame easily at 4.00 fps, and possibly up to 6.00 fps if your camera can do that.

Slate Speed: The speed at which the camera will shoot a slate when the button "Shoot Slate" on the Side Menu Bar is pressed. If this value is entered as 0.0, then the slate will be shot at the current camera speed as set on the Run Control Bar.

Slate Frames: The number of frames that will be taken when a slate is shot, not including the ramp frames, if any.

Min Ramp: This number determines the minimum number of frames needed to ramp the camera to speed. The main use of this would be to force the heads and tails of shots done at different speeds to be the same length. For example, passes at 4 FPS will have no ramp frames, but passes at 25 FPS might have 12 frames at each end. To simplify compositing the shots, one could force 4 FPS to have 12 frames of ramp, and in that way, all the takes would be the same length. A high setting here can affect the amount of preroll time the system needs.

Controller: Specifies which Mimic input is to control the axis. In controlling the camera axis, you are not controlling its position as you do with other axes, but you are controlling its speed. See the section on Variable Camera Speed for more data.

Handwheel Scaling: It is the scaling factor of the Mimic controller to Camera Speed. Right clicking on this entry box will bring up the "Camera Speed Scaling Calculator" which is similar to the "Manual Scaling Calculator" for an axis but additionally allows you to define the amount of change in camera speed you want - the "Ramp Range" and shows the controlling encoder's position as well as the scale and the resultant camera speed were you to be running the camera in a mimicked speed move.

Output Controls

There are several control functions associated with running a camera, and these may be controlled through the software. These control functions are: the switching on and off of the take-ups, the direction of the take-ups, the cap shutter and rackover. Rackover is found on some cameras, and allows the camera to be mechanically or optically moved out of the light path so that the image can be viewed. This is most commonly found on animation cameras.

Board and Port: Every Axis board has 4 spare output ports, and these can be used to control the above listed functions. You specify in the relevant box which board and which output port controls which function. If you have any trouble with knowing which function is wired to which board and port, then contact Mark Roberts Motion Control.

Cap Shutter: The operation of the capping shutter can either be "Manual" or "Automatic". In the manual mode, the user is responsible for opening and closing the capping shutter. In the automatic mode, the system will automatically open the capping shutter before taking a frame and close it again after the frame is taken. The user is always responsible for ensuring that the capping shutter is closed before winding film back.

Shutter Delay: If the capping shutter takes a couple of seconds to open or close, then this figure should be set to reflect that so that the system will pause, giving the shutter time to open, before the frame is taken.

Fast Pulldowns & Virtual Shutter Angles: When a camera is running, half of its time is spent exposing the film and the other half is spent moving the film forwards one frame while the shutter is closed. This can vary with some cameras with less than a 180 degree shutter. When you are running at very slow speeds, half of the time is then spent waiting for the camera to move the film forwards a frame which doesn't have to take a long time whereas the exposure must be done at the slower speed. Fast pulldowns and virtual shutter angle can be used to take advantage of this and to make shooting faster. You can also get the effect of more motion blur by setting a shutter angle greater than 180 degrees. These features will only work if you are running the camera at 1.0 FPS or slower.

Fast Pulldowns:
These are relevant when you are single framing the camera. When fast pulldowns are enabled, the camera will take the exposure half of the frame at the camera speed as stated on the run control bar. However, the transport part of the cycle will occur as

fast as the set acceleration of the camera will allow. This can significantly reduce the time it takes to shoot in single step motion. This mode will only work effectively when you are taking single frames.

Real & Virtual Shutter Angle:
This is a more complicated version of the above which works when you are shooting continuously. The basic concept is that by slowing the camera down during the exposure part of the cycle and whipping it around very fast on the transport, you can get the effect of a larger shutter angle than you really have. You have to enter the camera's real shutter angle into the computer and then enter the virtual shutter angle you would like it to emulate. Then the camera will accelerate as fast as possible to transport the film and slow down as the shutter is about to open and run at constant speed through the exposure part of the cycle and then whip the shutter round to the beginning of the next exposure cycle. If the rig is moving during this time, it will give the effect that you are exposing for longer than 1/2 of the movement and therefore will give a greater motion blur as well as shooting the move in as little time as is possible. If you cannot dial in a shutter angle of greater than 180 into your light meter, then the exposure time is increased by the ratio of the real to the virtual shutter angle. You must enter the exact camera shutter angle into the Real Shutter entry box and the desired shutter angle into the Virtual Shutter Angle box. You cannot currently use a smaller virtual than real shutter angle.

Due to the huge accelerations needed to achieve this effect, you may want to use this feature cautiously and be aware that high virtual shutter angles (greater than 270) are hard to achieve without placing a lot of strain on the camera. If you use this feature and the camera trips out, then you will have to reduce the shooting speed or reduce the virtual shutter angle.

Tuning: For details on tuning, see the relevant section under Axis Set-ups in this manual.

Please note that maladjustment on the tuning of a camera can cause camera flicker. You are strongly advised not to change these values once the camera has been flicker tested, and to re-test the camera over a range of speeds whenever these values are changed.

Setting up a Camera as an axis

0. If you have a delicate gate mechanism, it is strongly recommended that you remove it while you are setting up the camera.
1. Ensure that you have assigned the correct Board and Port numbers for the camera motor. Set the Encoder lines to the number of lines through which the encoder turns when taking 1 entire frame. This value MUST NOT be fractional.
2. Set the Maximum Speed to the fastest you want the camera to be run at, this would normally be 125.0 for a high speed camera and 25.0 for a live action camera and lower for an animation camera.
3. Set the Camera Acceleration to 40.0, the Camera Zero Offset to 0.0, the Camera Fwdoff Angle to 0.25 (1/4 of a turn) and the Backoff angle to 0.0.
4. Set the tuning values to 5, 5 and 5.
5. Release the emergency stop, and click on the camera engage/disengage button which is at the top right hand side of the Numerical display and is usually labelled "Frame", and is right next to the button labelled "Posn". When this button is clicked on, it should go from white to black, and the Camera should engage and zero itself.

   Conditional: If at this point the camera runs off briefly and then stops, the power leads to the camera motor need to be reversed, handle and repeat step 5.

   Conditional: If a message appears stating that the camera is buckled then the limit wires have not been connected properly or the buckle switch is tripped. Handle and repeat step 5.

   Conditional: If an error message appears stating that the "Axis Zero Timed Out", then the axis either didn't move (amplifier fault, wiring error etc.) or no zero marker pulse was found (encoder has no zero marker pulse, mis-wired or the Encoder Lines value is wrong). Handle and repeat step 5.

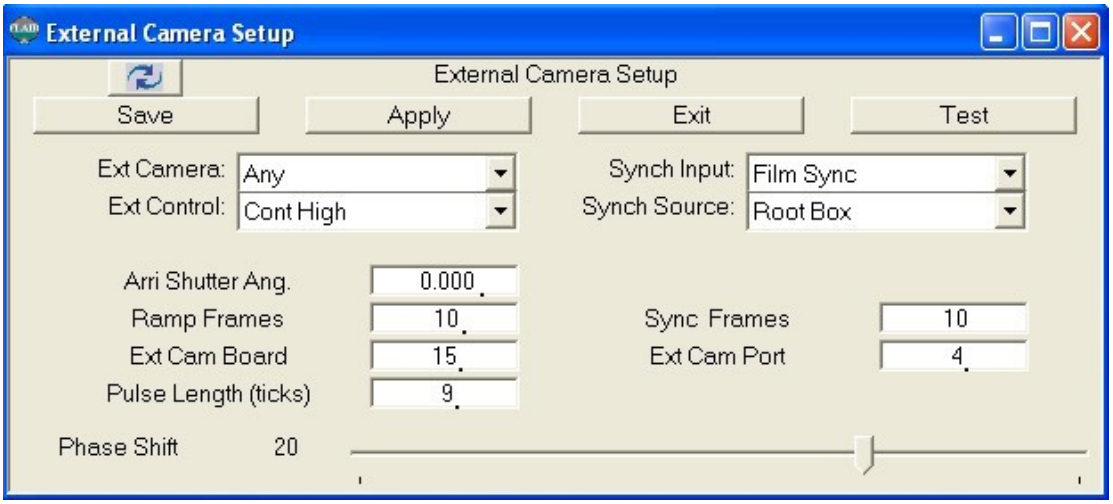
   a. Set the camera speed to 1FPS, switch the camera into "RECORD" (not dummy) on the Run Control Bar and if you have “Take Ups”, then engage them. Then press the “Take” Button (Observe that the camera is running in the correct direction. If it is not, then check the “Reverse Direction” box.
6. Compare where the camera is to the correct zeroing position for the camera. (Usually with the shutter closed and half way through the transport phase.) If this amount is greater than about 1/8 (ideally less than 1/16) of a turn, then the motor or encoder will have to be adjusted so that the zero marker pulse on the encoder is closer to the correct zero position. Get this corrected.
7. Disengage the camera and move it manually to its correct zero position. Then go back into the camera Set-up display and using the mouse store button, enter the current camera position into the Zero Offset. This value should be between -.25 and + .25 at the very worst and should be between -.1 and +.1 for best results, and to avoid exposing film when the camera zeros. Apply this value.

8. Re-engage the camera and verify that at the end of the zeroing procedure it stops in the correct position. If not, set the Zero Offset back to 0 and repeat from step 5.
9. Set the camera speed on the Camera Control bar to 1 FPS and. Press the “Turnover” button, the camera can be stopped by pressing the "Turnover" button a second time, or by using the Mouse Stop Button.
10. Set the camera speed to the highest speed at which you want to single frame.
11. Note how many ramp frames are required by noting the number that appears to the right of the turnover button. If this number is 1 or greater, then increase the Camera Acceleration until the number reduces to 0. (It is recommended that you then add about 5 or 10% to give a margin).
12. Set the slate frames to 1 and the slate speed to the highest single framing speed you desire, and try shooting a few slates forwards and backwards and make sure that the camera only takes one frame each time. This can be checked on the camera, or by looking at the number of frames used display at the bottom of the numerical display.
13. Adjust the tuning of the motor as per the relevant section in the axis Set-up section of this manual.
14. Verify that the motor will run properly at the highest desired speed (usually 125.0). If it doesn't run this fast, then it could be an amplifier fault or insufficient voltage. This may require assistance from Mark Roberts Motion Control to handle.
15. If you have output options for your camera such as take ups and a cap shutter, this can now be set up. You have to assign the correct Board and Port for these outputs which will have to be done in conjunction with whoever wired up the hardware. If you have these options, they can be tested by selecting the relevant button on the Run Control bar. These buttons are as follows: “Take Ups Tensioned/Slack” for the Take Ups on off toggle. “Cap Shutter Open/Closed” for the cap shutter. “Direction Fwd/Rev” for the take ups direction. “Rackover View/Take” for the rackover.
16. Save and Apply the Set-up in its final form.

External Camera Set-up

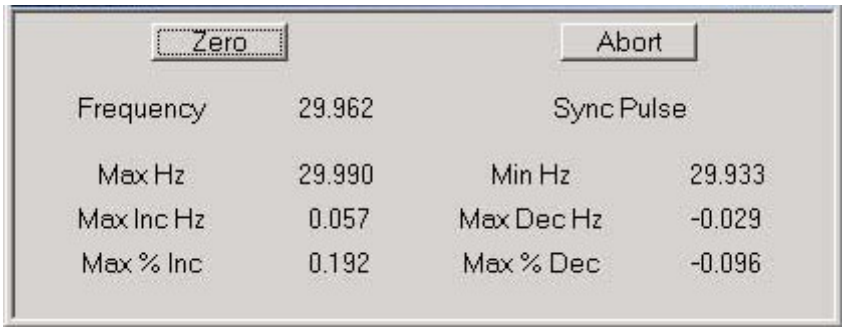
Synchronisation

The Set-up allows the user to synchronise the system to an external video or film camera. If you are running the software as a video system, then this will be the usual operating situation for the system, and a video signal from the camera (directly or indirectly) needs to be plugged into the back of the root box so that the system has a signal to synchronise to. When you are synchronising to an external film camera, then an input needs to be wired into the triggers input in the root box (contact Mark Roberts Motion Control for wiring assistance), and then the system can be synchronised to your external camera at any speed up to 300.0 given that your camera produces a stable regular pulse to be synchronised to.



Save, Apply & Cancel: This dialogue box supports the standard buttons for storing the Set-up data to disk, implementing any changes that have been made, or rejecting any changes.

Test: This button brings up a diagnostic box that allows you to study the incoming synchronisation pulses, and see if they are coming in, and what frequency they are arriving at. This can be used to determine the precise frequency of the incoming pulses, and to find out if they are coming in at all. The current incoming frequency will be displayed in pulses per second and a label will say "Sync Pulse" if pulses are coming in, and will be “No Pulse” in otherwise.



Ext Camera: This switch tells the system whether there is an external camera in use or not. When this switch is set to "ANY", if the internal camera is disengaged and you

try to run a move in record mode, the computer will know what you are trying to synch to an external camera. Other specific cameras may be added to the option list with later versions of the software.

Synch Input: This states which kind of incoming synch pulse is expected by the system. If this is "OFF" then the system will not try to synch. In "Film" mode it will expect a synch input on the film sync input (See chapter on Synchronisation). In the "VTR Sync" mode it will attempt to sync to a video pulse and lock the timings of the entire system into the incoming PAL sync signal. If you want to sync up to an incoming video signal other than when you are using a VTR, then do NOT use "VTR Sync", use "Film Sync". The option “Tape Sync” should not be used.

Sync Source: The camera signal to which the rig needs to synchronize can come in to a number of different hardware points, ranging from the main computer to any of the axis boards used in the system. This menu allows you to select which board the sync signal will be used from.

Ext Control: Many cameras can be started and stopped by means of a simple switch closure or electrical pulse. This switch allows you to define the type of pulse the controlled camera expects. Some expect a single pulse to start and one to stop, others expect a switch to remain closed while they are supposed to run. If this field is set to other than "None", then the computer will always trigger an external camera a number of frames earlier than the move, depending on the setting of "Ramp Frames" and "Sync Frames" below. This will affect the required preroll time for the move.

Ramp Frames: You must enter here the number of frames the camera takes to get up to the speed that you are going to run the move at. This data will most likely be obtainable from the manufacturer, or by experimentation. This value is 0 for a video system or if you allow the motor to get up to speed before you trigger the move. In the case of a camera that is being triggered by the computer, this allows the camera to get up to speed before the move actually starts.

Sync Frames: This is really just a buffer of a few frames to ensure that the system has locked sync before the move starts. It needn't be more than a couple of frames at most.

Ext Cam Board: The external camera can be switched on using one of the general purpose axis board outputs. This number assigns the board (discounting mimic boards), which will be used to switch on the external camera.

Ext Cam Port: As above, this assigns the port on the above assigned board, which switches on the external camera. Contact MRMC for wiring connections etc.

Pulse Length (ticks): Where the output to control the camera is selected as a Pulse, this value sets the length of the pulse. It is measured in 50th of a second. Some cameras need a very short pulse but many need a long enough pulse for them to detect the pulse. Typical values are 10 ticks (1/5 of a second).

Phase Shift: This slider bar allows the user to adjust the timing relationship between the system and the incoming synchronisation pulse. This value is the amount of a frame between the start of the frame in the system, and the arrival of the sync pulse. This slider can be used to adjust the system so that when you shoot a TV screen, you

can get the sync bars off screen. This value is immediately used by the system; you do not need to Apply the value. (Getting rid of the sync bars also depends on the camera shutter angle!) The units are in percentage of a frame +- 50%.

WARNING: With a slightly unstable pulse, you should not attempt to adjust the phase shift more than +/- 35 as the system may become unstable, and the move could be stopped.

Please note that if you are shooting a video screen, due to the design of the camera and its shutter, the sync bars could be off screen when the screen is in one area of the shot, and back onto the screen when you are in another area of the shot. It is best to use a camera with a 180 degree shutter to minimise this effect. The reason for this is that the exposure time varies across the shot, and up and down due to the rotational motion of the shutter.

Timecode Set-up & Frame Overlay Set-up

These dialog boxes allow you to control the appearance and operation of the frame count overlay and the timecode system within the RT10 hardware. These options may not be available on your system depending on the hardware you have installed. With older versions of the hardware (Transputer Rootboxes) both of these features were accessible through serial ports and so they were configured through the serial devices set-up, which controls how they work, and how they appear to the user.

Frame Overlay

Note: Not all features are available on both the Ric Text Inserter and the Horita Serial Titler.

Save: Saves the current set up to an ASCII file in the /configs directory called Frameout.ini This file has the same format as other .ini files, (See section "Advanced Configuration") and can be edited by the user. It is read only when the program starts up.

Use: Sends the current settings to the Horita.

Exit: Closes the display.

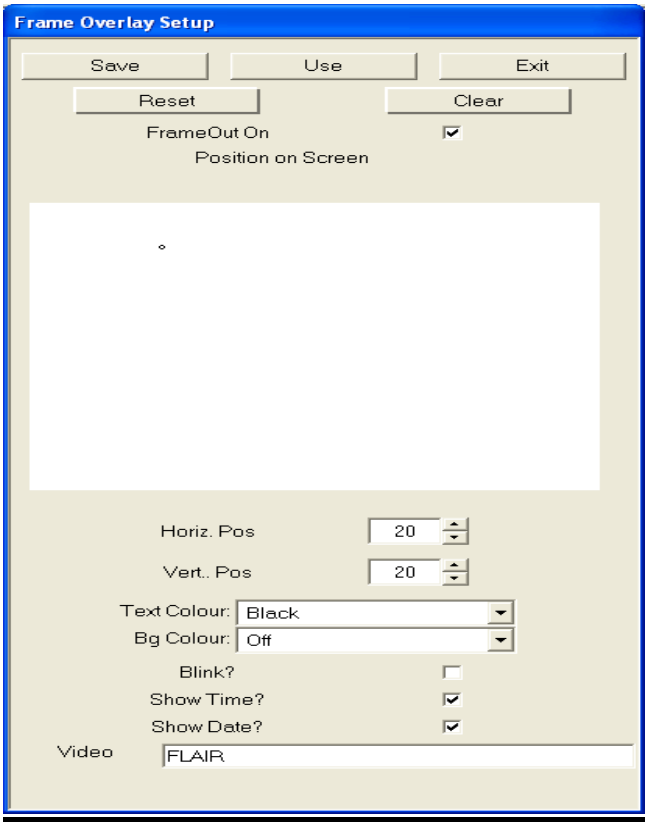
Reset: Sends a reset command to the Horita Serial Titler and cause it to assume its default values

Clear: Sends a "Clear" command to the Horita which should cause any displayed text to be cleared off the screen.

FrameOut On: This is a check box to turn on and off the Frameout. With the Ric this is the sole on/off control for the Frame Overlay. With the Horita, you can also turn it off in the serial setups.

Position on Screen: The position of the text on the screen is easily moved either through typing a number or nudging the Horizontal and Vertical positions or by

clicking on the white square to re-position the text output. Placing the text too far one side or end can cause the text to wrap across the screen.



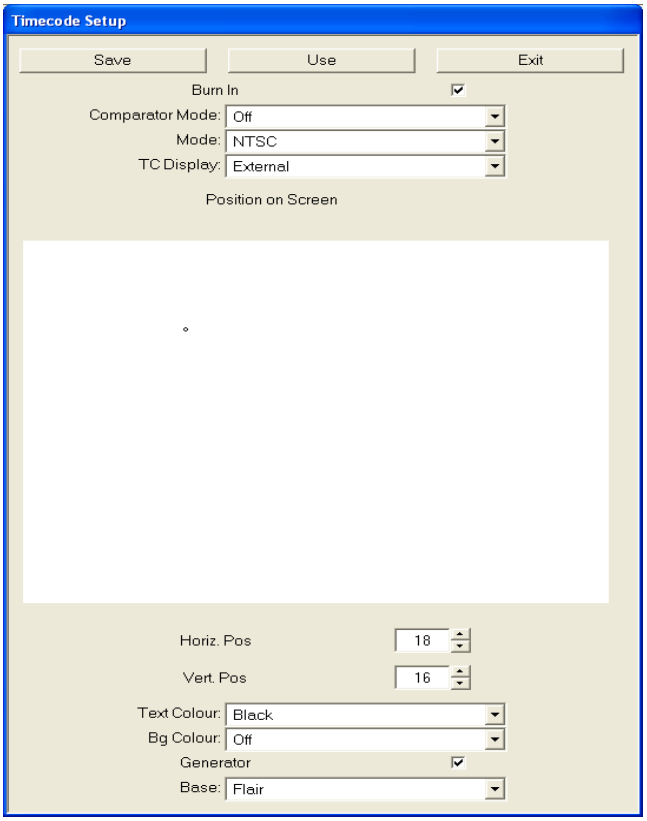
Text Colour: The text can be black or white on the screen and the best setting depends upon whether you are using a solid background and what the predominant colour is.

Bg Colour: Allows the user to set the text background on or off. Its colour is the opposite of the text colour

Blink: The text on the Horita can be set to blink.

Show Time: / Show Data: The Horita may optionally show the time and date on the screen. This might be useful in some cases, but the position on the screen can only be changed through the Horita's set-up menu.

Timecode Set-up



Only available on the new RT10 hardware. An OEM timecode comparator is available for use with the older style rootboxes, but has limited functionality and cannot generate, only read timecode. (See "Serial Devices – TCReader")

Save: Saves the current set up to an ASCII file in the "/configs" directory called Timecoder.ini. This file has the same format as other .ini files, (See section "Advanced Configuration") and can be edited by the user. It is read only when the program starts up.

Use: Sends the current settings to the timecode device.

Exit: Closes the display.

Burn In: The current timecode can be burnt into the video image if it is routed through the RT10 and this option can assist with lining up multiple passes. The "Position on Screen" is only relevant when this option is selected.

Comparator Mode: The options are "Off", "TC Comparator" and "Store Start TC" In Comparator mode, the timecode that is running is compared to the requested start timecode and if there is a match, the move is triggered at that point. "Store Start" means that when the "Shoot" button is pressed, the timecode at that time is stored and may be used later to trigger the move at the same time as it was manually triggered.

Mode: Switches between 25 frame PAL base timecode and 29.97 NTSC based timecode.

TC Display: Selected whether to use the internal or external timecode for triggering. If you select the internal timecode, you must also switch on the timecode generator.

Position on Screen: Positions the timecode burn in which must be selected for this function to work. See above similarly named section for details of operation.

Text Colour: See above similarly named section for details of operation.

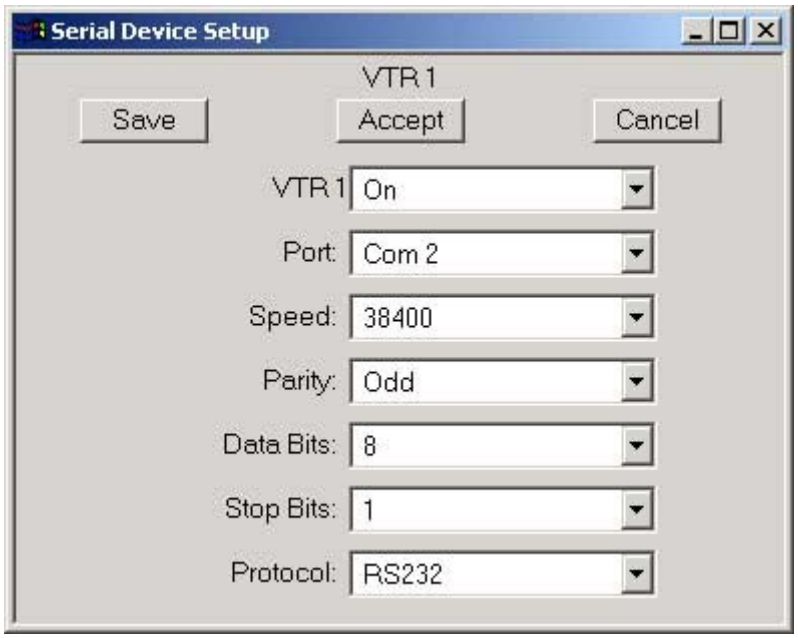
Bg Colour: See above similarly named section for details of operation.

Generator: Sets if the timecode is generated by the RIC or not.

Base: Options are "Flair" and the other standard timecode time bases. When Flair is selected, then the timecode base is the current camera speed. This may not work with other timecode systems and therefore is not recommended except for burn-in purposes.

Serial Devices Set-up:

There are several serial devices that can be connected to Flair to add additional functionality to the system. These devices all have a separate screen to define their operation and their serial communications protocol. The basic screen looks like this:



The standard Save, Apply and Cancel buttons operate as expected. The top pulldown is a selection is the "Mode Selector" which turns off the serial device or sets its operation mode. The different operation modes are covered below and differ from device to device. The "Port" sets which serial port the device is connected to. In the case of Flair running with a transputer system, the options are "Tram 1" and "Tram 2" with Flair running on a windows system, then the ports available to the machine are listed. Should you select a port that is not available or otherwise in operation, and error message should inform of this.

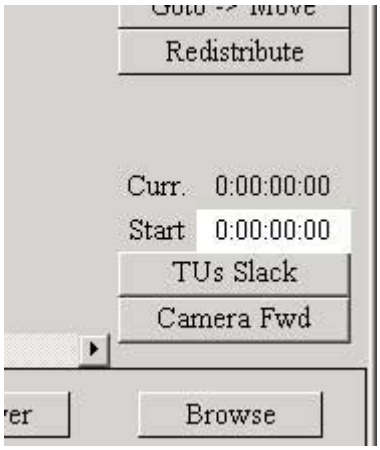
The following 5 pulldowns are standard serial communications selections, and these should be determined through MRMC or through the details of the device. The protocol selection is only valid with the serial Tram supplied through MRMC and is non functional in Windows™ where the protocol is determined through the hardware or Operating System.

Available Serial Devices:

VTR: With a system that is configured to run the VTR, you have the option of setting the port and communications settings. Normally a VTR uses the Sony® protocol and this is 38,400 Baud, Odd Parity, 8 Data Bits and 1 Stop Bit. The top selection simply turns the VTR on or off.

Frame Output: The current frame or time in seconds can be output from a serial port during the move or while browsing. This can be used to insert a frame count onto a video picture or control a record or playback medium. The first 2 options (Horita Frame and Horita Time) are for the Horita Serial Titler which inserts the data sent to it into a video signal, this allows easy matching of frame counts between playback and the move and is a very useful tool which can be used on most any motion control job. The ASCII option sends the data out as an ASCII stream and can be used in other applications one of which is slaving a Perception Video recorder to the system. (Though only at slow -< 4FPS- speeds)
This functionality has been built into the newer hardware (RT10) and you do not need the Horita device. In this case, use the "Frame Overlay Set-up". Please note that the frame count is not absolutely frame accurate as it depends upon the update speed of the titler and also on the video speed. At higher than live action speeds, the video still only runs at 25/29.97 and you may find an increasing offset between the actual frame count and the number on the screen. Flicker free video tapes exacerbate this situation. However, used right this is an extremely useful tool.

TCReader: The time code reader option is for another Horita product which reads the Timecode from a standard SMPTE track and can run below speed and up to 3 times normal playback speed. When this option is enabled in the start-up config file, then a display will appear in the right hand control menu showing the currently read timecode and the desired starting timecode. More of this is in the Chapter on Inputs and Outputs.



This option is provided by setting the TC Reader Mode Selector to "TC Comparator" If you select "Store Start TC", then the system will record the timecode at which the

move was triggered when you last ran it. You can use this mode to record the start TC, and then switch to the normal “TC Comparator” mode to play back in sync. Please note that recording in sync with Timecode can be a complex subject and a fully study of it is recommended before committing to a shoot.

RT Data Output: "Off/50Hz XYZ/Synch XYZ/50Hz Axis/Synch Axis/Ascii". (RT = Real Time). This option will only work if you have purchased the real time data output option for Flair and had the correct hardware added to your system. Normally the button will be left as "Off"; when in 50Hz mode, the computer will output one packet of XYZ camera and target data every 20 milliseconds. When in "Synch", the packets will come out depending on the incoming synch pulse. Please note that the packets will still be sent at the end of the internal system tick (20ms) but the data will be adjusted to match the timing of the incoming sync pulse. The Axis positional option works similarly, and the Ascii option is simply a different data format. For more information of these formats, consult MRMC. If you set this value to other than "Off" but it resets itself to "off", then you do not have the correct hardware/software Set-up to run the real time data output and you should contact MRMC for assistance.

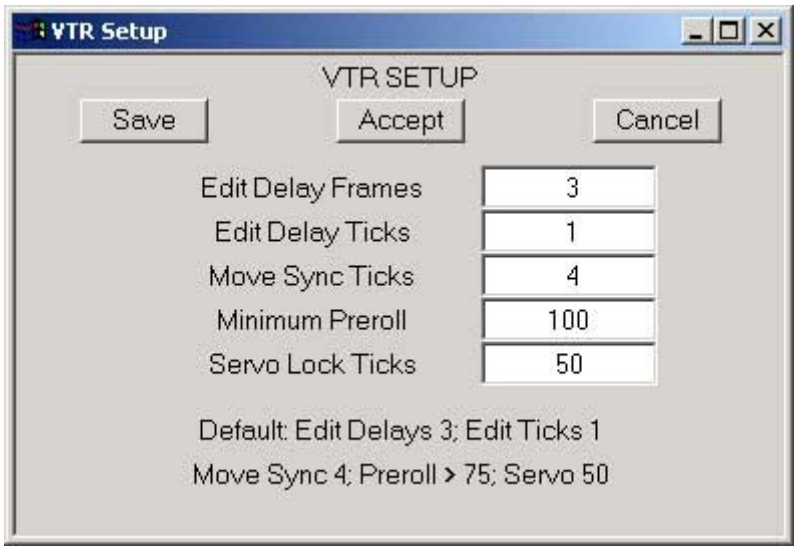
RT Data Input: Data input into flair can be used to control the position of the rig from an external source. This feature should only be used in consultation with MRMC.

Other Options may be available depending on the application flair is being used for.

VTR Set-up.

(Only available with PAL video systems)

The VTR Set-ups allows the user to adjust the timings between the Flair system and the VTR to account for differing reaction times in the VTRs. The default settings are for a Sony BVW75, which is quite a common machine. Adjustments to the variables should be done with care as a slight change may appear to work, but may shift the recording forwards or backwards a frame and in single framing shoots may cause frames to be missed out or recorded over.



Edit Delay Frames: The number of frames delay between the machine being told to start recording and when it starts recording. Obviously, the command must be issued this amount of time prior to the desired recording. The specific command is "Edit ON" per the standard Sony RS422 protocol.

Edit Delay Ticks: This is a secondary internal timing factor that should be 0 or 1. It is best to leave it as 1 unless specifically instructed otherwise by MRMC personnel.

Move Sync Ticks: This is a timing factor that relates the position of the timecode to the actual position of the motors. Without getting heavily into it, it delays the VTR slightly so that the exact right part of the move is being recorded.

Minimum Preroll: Normally when you issue an edit command to a Sony machine, it will preroll 5 seconds before the desired In point, start playing and when it reached the In point, it will being recording. 5 seconds is quite a long time, but it is the recommended delay, I have personally cut this down to 3 seconds with no apparent ill effects. If you are doing a lot of single framing, it will save a lot of time to cut it down to 3 seconds or maybe even less, but otherwise leave it at 4 or 5 seconds to be safe (100 or 125 frames on PAL)

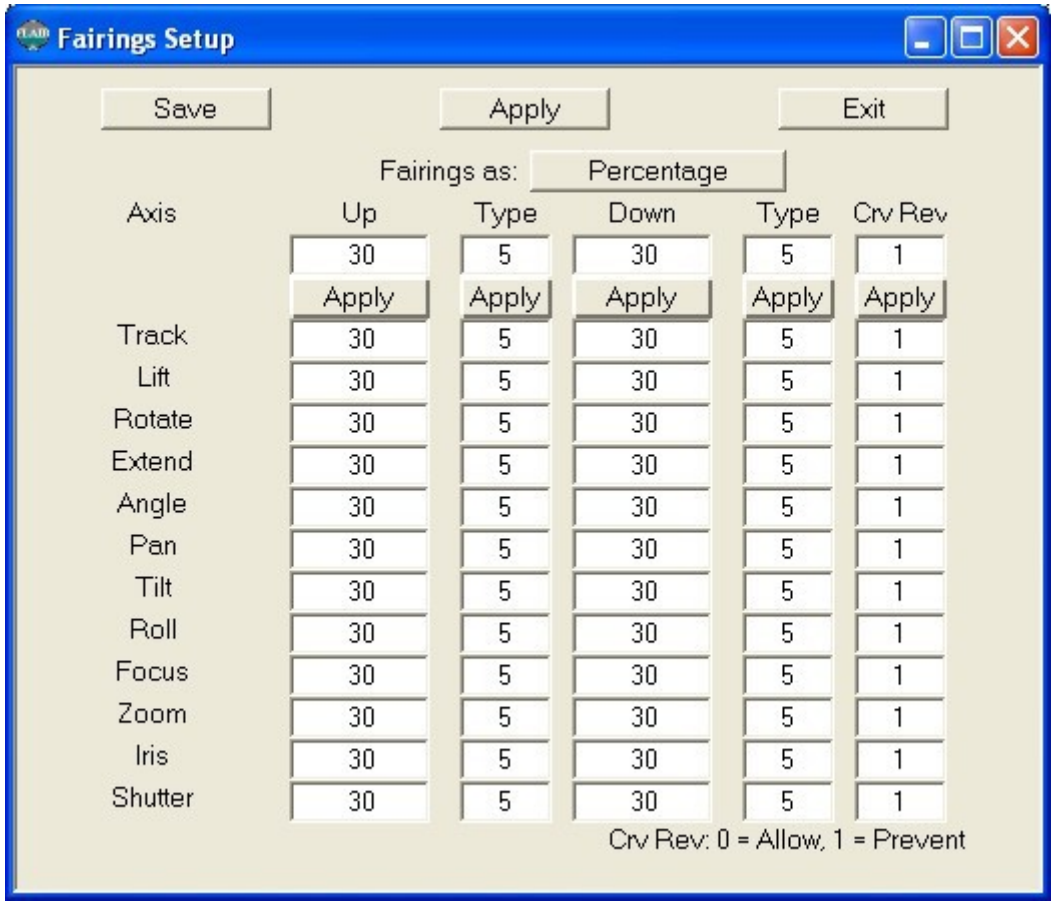
Servo Lock Ticks: Not used, replaced by the above.

Fairing Set-up

For a description of fairings and how they work, see Chapter 7 Move Entry.

The fairings pull down menu allows you to select from up to 4 possible options. Axis fairing, axis waypoint fairing, 3D fairings and 3D waypoint fairings .The Axis Fairings Set-up allows you to modify the fairings for each axis for the entire move. The Axis Waypoint Fairings allow you to specifically select which waypoint you wish to change the fairings on. Please note that changes in the Axis Fairings will overwrite any changes made earlier in the Axis Waypoint Fairings. The second 2 options (3D Fairings) will only be available if your system supports Target Tracking. In this case you will have the same 2 options for changing the fairings on the XY&Z of the Camera path and the XY&Z of the target path for the whole move or for specific waypoints.

These displays are similar and are not shown individually. The main difference apart for the Axes listed is that in the non Waypoint display, the Waypoint entry button is not shown; in the Waypoint display, the Save button is not present, and there is no fairing “Type” column



Frames\Percentage: This is a toggle which allows you to change between stating the fairings in frames or in percentage of the move.

Waypoint: This field allows you to specify which waypoint you want to change the fairings on. It is not shown in the default fairings display, only in the waypoint display when this can be used to set which waypoint you are going to change the values on. If you have selected waypoint #2 then the Up value will change the way in which the motion leaves point 2 heading to point 3 and the Down value will affect the way in which the motion approaches point 2 having come from point 1. On the first waypoint, the Down value has no significance and on the last waypoint the Up value has no significance.

Up/Down: In these columns you state how many frames (how much percentage) of the move you want the fairing up or the fairing down to last for. In Percentage mode, permissible values range from 0 to 100, in frames mode, 0 to 999. Overlaps between the up and down fairings are truncated. Note: Very short up or down fairings will of course require larger accelerations.

Type: The type of a fairing affects the shape of the speed up or slow down curve. When 0 is selected, the axis will accelerate harder earlier in the fairing, and with 9 it will accelerate harder later in the fairing. The permissible values are 0 - 9, the middle value 5 is a symmetrical "S" shape.

CrvRev: This field indicates whether curve reversal handling is in operation for that axis at that waypoint. A "1" indicates that any curve reversal will be handled, a "0" indicates that no curve reversal handling will be done. See Sections later in this

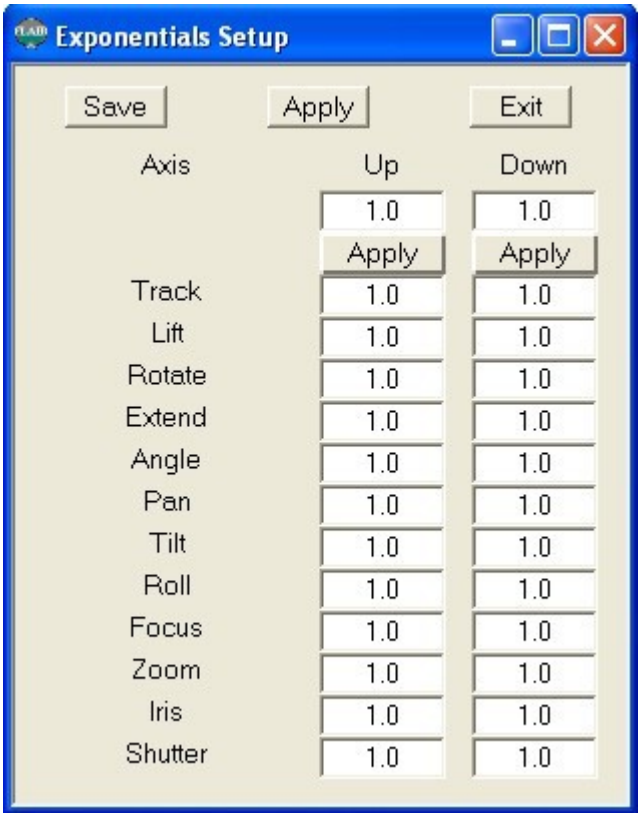
manual for a full description of Curve Reversal and its effect. This field is more easily changed through the graphics displays.

Apply: This button is pressed if you wish to apply the value in the "All Axes" box to the corresponding value for each axis.

Axes: Different fairings can be set for each axis, simply select the relevant field and type the required value in the box. The applicable box for each axis is listed next to its name. If there are more than about 8 axes, then a scroll bar will be provided to access the later axes.

Exponentials Set-up

For a description of exponentials and how they work see Chapter 7, Move Entry.



Up & Down: In these columns you state the relative proportions of the start and end velocities. i.e. if you want the end of the move to be twice as fast as the start, you can enter 1.0 in the start, and 2.0 in the end. This is in fact identical in effect to typing 0.5 in the start and 1.0 in the end. Negative values are not accepted. Exponentials are turned off by entering numbers with a ratio of 1 to 1 in the start and end columns.

Apply: This button is pressed if you wish to apply the value in the "All Axes" box to all axes.

Axes: Different exponential ratios can be applied to each axis or as desired. Simply select the field you want, and type in the required value.

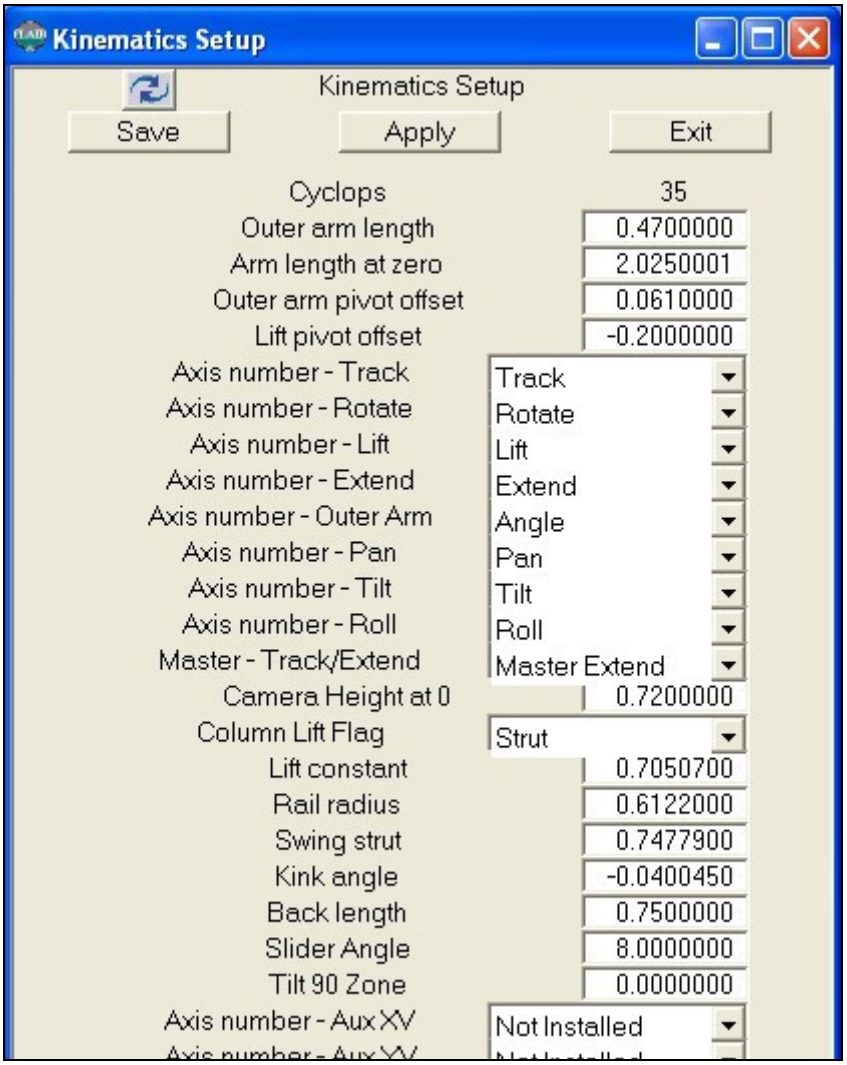
Inputs and Outputs Set-up

See Chapter 17 “Inputs & Outputs” for information about using Trigger Inputs and Outputs.

Kinematics Set-up

There are currently many supported Kinematics "models". By this we mean the general configuration of the rig.

The exact layout of the kinematics display depends on the kinematics model you are using, but the principle is the same, the name of the parameter is listed on the left, and the value on the right. Many values are numerical distances which are always measured in metres - angles are measured in radians – contact MRMC for any needed parameters. If the parameter is an option, then there will be a pull down selection on the right. Shown here is part of the Cyclops kinematics set-up which is used for the Cyclops rigs and the Milos.



CYCLOPS is named after the Large Mark Robert's Motion Control Rig whose basic configuration is a track upon which there is a rotate, on this there is a lifting arm which can extend, at the end of the arm is a secondary shorter arm which ends in a pan and tilt head. (This configuration also works for the Milo and the configuration can be called MILO).

PANTHER is named after the Panther dolly. This one has a track, rotate and lifting jib arm and a head that is automatically kept level, and a pan and tilt head.

SIMPLE DOLLY; this is similar to the panther except that there is no means of moving the camera across the track side to side, as you would have with a rotating jib arm. This target tracking model does not do true target tracking and will not output true XYZ data, but it will follow the target! The camera can be on a jib and may be positioned off of the central column of the dolly.

ORTHOGONAL refers to a rig where the track, lift and side-to-side movements are all linear and connected orthogonally (at right angles). This is also sometimes called a crucifix rig.

HEAD is a simple pan and tilt head. The only reason it has a kinematics Set-up is for the import and export of data as the operation of such a unit does not really require target tracking. The Set-ups are simply Pan, Tilt, Roll and Focus.

OFFHEAD is almost exactly the same as the panther model except that the axis of tilt is not aligned to the axis of pan. This offset is added to the kinematics Set-up and is otherwise the same as the Panther Set-up.

OVERHEAD is used for large rigs that are similar to the Cyclops but also have a side-to-side motion of the turret. These are normally mounted overhead - hence the name.

TABLE is used for animation tables where you wish to be able to look at and modify the camera as a path of motion. Set-ups are self-explanatory and are not covered here in detail.

JUNO is similar to the panther in basic operation, but the pan axis can be tilted and locked in different positions. It also has the option for an extending arm, and this makes this model more complex. Rigs supported under this category include the Technocrane, The Animoko style rig and the Juno.
ANIMOKO and TECHNOCRANE styles convert internally to this model.

ANIMOKO converts internally to JUNO model.

TALOS refers to a rig with similar kinematics to a Juno but to make without the ability to set the head at different angles, only vertically up or down.

TECHNOCRANE refers to a rig with the same shape and axes as a standard Technocrane.

MULTIHEAD
Not yet implemented, but designed to have multiple heads tracking a single target.

HEXAPOD (or MOTIONBASE) refers to a rig that consists of a platform with 6 actuators that can move in 6 degrees of freedom. It is generally used for moving models or sets and not for moving the camera. It can have a rotator on the bottom or the top for additional functionality.

STAUBLI The Staubli is originally an industrial robot arm which was converted to a motion control arm; it was modified to be controlled from FLAIR.

- The actual name of the kinematics model does not necessarily match the name of the rig, the terms are historical and apply to the general geometric configuration. For example, the Mark Roberts Motion Control Milo rig uses the CYCLOPS model through it is quite different in size and shape from a Cyclops rig.

- All parameters are measured in metres where applicable or radians.

- Some parameters are common to all models such as the Axis Numbers and the Camera Height at Zero so they are described here:

Axis Numbers: The program needs to know which axis provides which motion. Select from the listed axes names on the right, which one performs the motion described on the left hand side. If you have any questions, contact Mark Roberts Motion Control as an error in this set-up will prevent Target Tracking from working. If an axis does not exist on your system, then select "Not Installed".

Auxiliary Axes: Aux XV, Aux YV, Aux ZV, Aux XT, Aux YT, Aux ZT: These are axes which can be used to adjust a Target Tracking move. Their use is fairly advanced and covered under the Target Tracking section of the manual. One simply selects which axis is being used for the function or selects "Not Installed" if you are not using the axis.

Axis number MM Pan, MM Tilt, MM Roll: If the rig is looking at model mover with up to 3 degrees of freedom, then the rig can be locked to the model mover and when the model mover is adjusted, the rig stays in the same relative position to the item on the model mover. If you do not have a model mover installed or you are not using this function, these MUST be set to "Not Installed"

Model Mover X Position, Y Position, Z Position: These define the position for the model mover relative to the 0,0,0 of the rig. This is normally in the centre of the turret on the floor if the rig has been set up correctly. Only relevant if you are using the model mover with the rig locked to it.

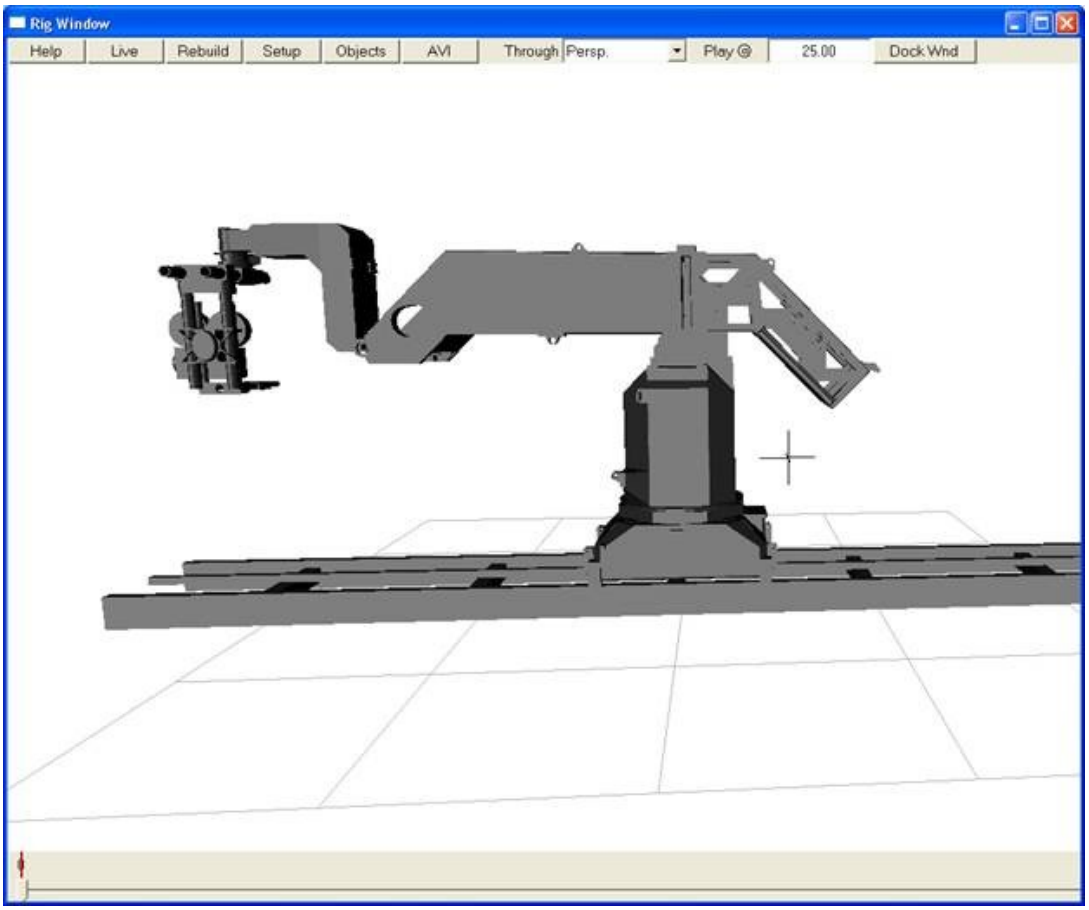
Camera Height at Zero: In order to make the 3D views provide a comprehensible representation of the studio; the rig needs to know where the floor is. This value is actually of no use to the system, but it does make the numbers easier for the user and interfacing with other systems. This value is set to the height of the Nodal Point off the floor when the rig is at its zero position.

Tilt 90 Zone: This is the range of tilt position either side of tilt -90 that the computer has to use special maths handlings in order to operate correctly in Target Tracking. The basic problem is that the camera pan axis acts only as a roll when you are at tilt -

90 (also +90 though that is rarer). The tilt 90 handlings are developmental as of version 5.00 and cannot be expected to operate entirely correctly.

As well as each rig having a different kinematics model, each one can also have a different lift mechanism, for example a Cyclops can have a motor that rotates the jib arm about a pivot to lift the arm (called an angular lift) or it can have a strut that extends from the base to lift the arm (called a strut lift). Following the description of the kinematics models there is a description of the different lift options, which are applicable to some rigs.

Talos:



Cyclops: (Or Milo)

Outer Arm length: This is the length of the outer arm, also called the Angle or Pitch. The distance is from the axis about which it rotates to the tilt axis.

Arm Length at Zero: The length of the arm when the extend is zeroed. This is the distance from the lift pivot forward to the outer arm pivot measured horizontally when the arm is horizontal. If there is no extend axis, then this value is simply the length of the arm.

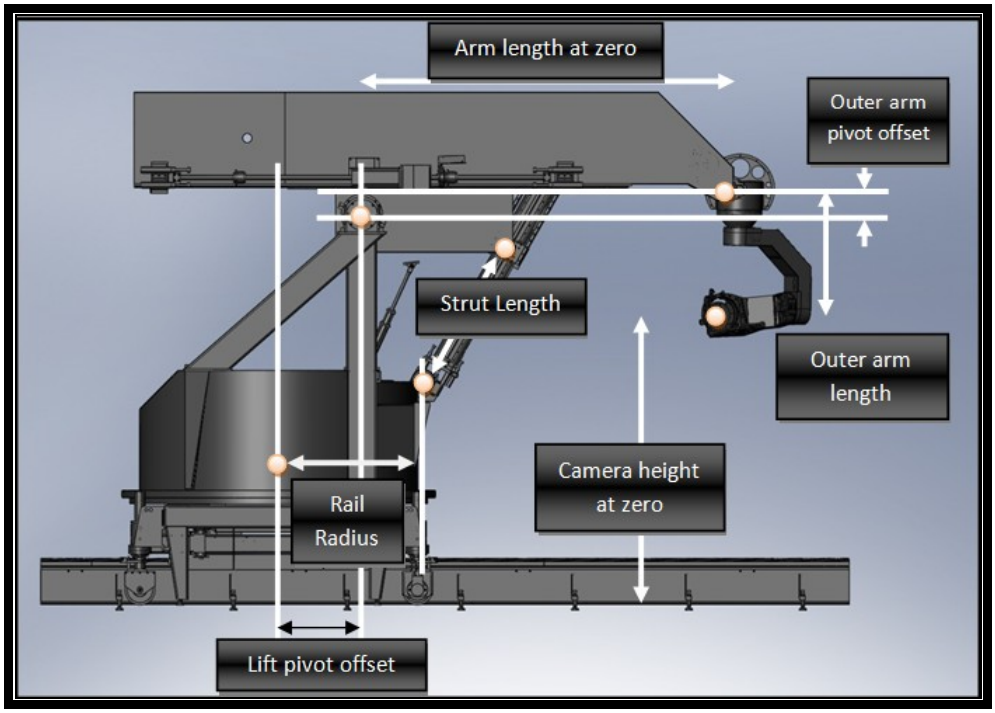
Outer Arm Pivot Offset: The vertical height difference between the lift pivot and the out arm pivot when the arm is horizontal. It is measured up from the lift pivot to the

outer arm pivot, and this value can be negative. This value is usually about 8cm i.e. 0.08 metres.

Lift Pivot Offset: The horizontal distance of the lift pivot forward from the centre of the rotate. The absolute height of the lift pivot is irrelevant as far as the kinematics is concerned as it is a constant and does not change when the axes move.

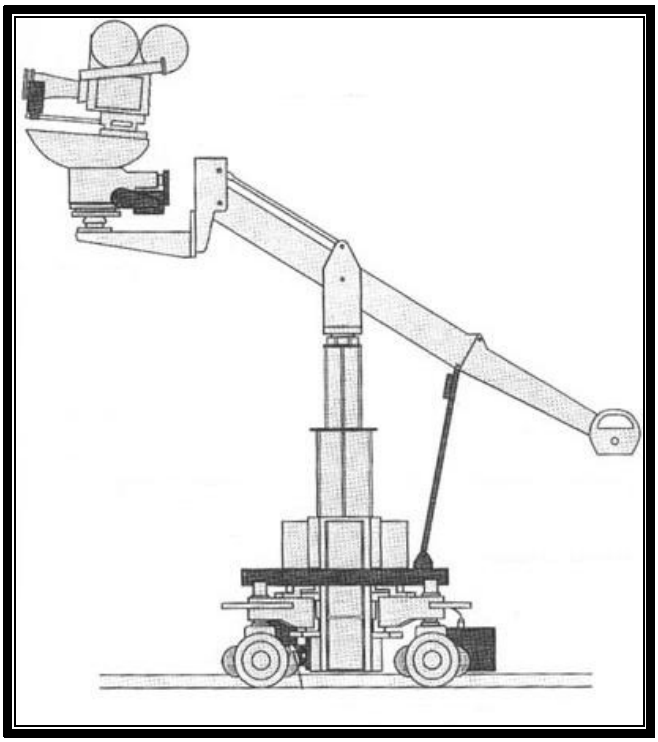
Master - Track/Extend: When a rig has both an Extend and a Track axis, these axes can both produce the same sort of motion. In order to resolve possible ambiguities produced by this, one of the axes is set as a Master axis; since it could be either, this flag can be changed to indicate accordingly. There are advantages and disadvantages to each one. Normally it is better to have the track as the master axis as that allows more movement of the rotate when target tracking and this is done by setting the Master Flag to "Track Master". If however you want to run a Scaling job, then the best solution is to use the Extend as a Master axis, and this is done by setting the Master Flag to "Extend Master". If you have no Extend axis, then this flag has to be set to "Extend Master".

Lift Column Flag: See section below on lift models.



Auxiliary Axes: Aux X, Aux Y, Aux Z: These are axes which can be used to adjust a Target Tracking move. Their use is fairly advanced and covered under the Target Tracking section of the manual. One simply selects which axis is being used for the function or selects "Not Installed" if you are not using the axis.

Panther: (or Modula)



For the first section of the Kinematics Set-ups, see the section headed 'Lift Models' further below.

Simple Dolly:

This is in fact identical to the Panther Set-up. the only differences are that there is no rotate axis, and the addition of the jib position flag.

Jib Position NWES: This indicates the presence and position of the superjib. If there is no superjib, and the pan tilt head is mounted directly on the lift column or simply at a fixed height, this value should be set to NONE. Please note that regardless of the jib position, the pan zero is looking up the track in the positive track direction.

Orthogonal:

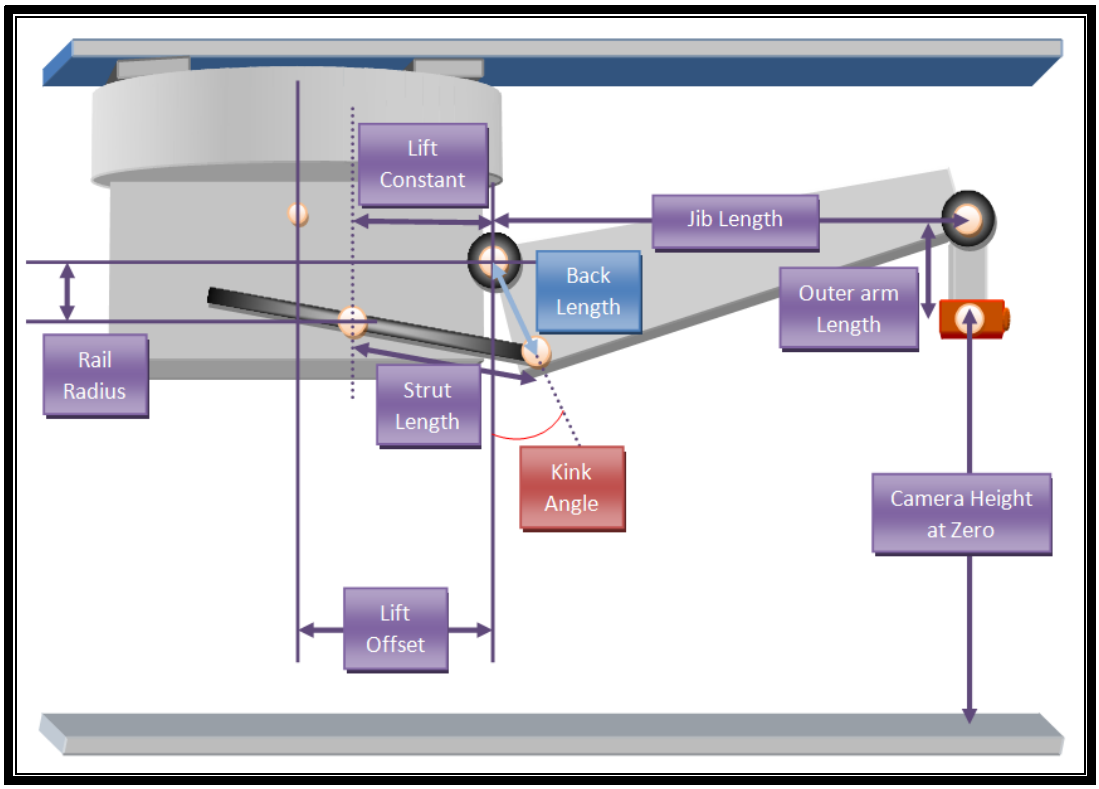
Camera Side Offset at 0: This is the distance from the centre of the track sideways to the optical axis. It is relatively unimportant and can be set to 0.0. It allows you to set the side to side zero for XYZ output.

Overhead Rig:

Outer Arm length: This is the length of the outer arm, also called the Angle or Pitch. The distance is from the axis about which it rotates to the tilt axis.

Arm Length: The length of the arm. This is the distance from the lift pivot forward to the outer arm pivot measured horizontally when the arm is horizontal.

Lift Pivot Offset: The horizontal distance of the lift pivot forward from the centre of the rotate. The absolute height of the lift pivot is irrelevant as far as the kinematics is concerned as it is a constant and does not change when the axes move.



Juno: (or Talos or Technocrane or Animoko)

Outer Arm length: This is the length of the outer arm, also called the Angle or Pitch. The distance is from the axis about which it rotates to the tilt axis.

Lift Pivot Offset: The horizontal distance of the lift pivot forward from the centre of the rotate. The absolute height of the lift pivot is irrelevant as far as the kinematics is concerned as it is a constant and does not change when the axes move.

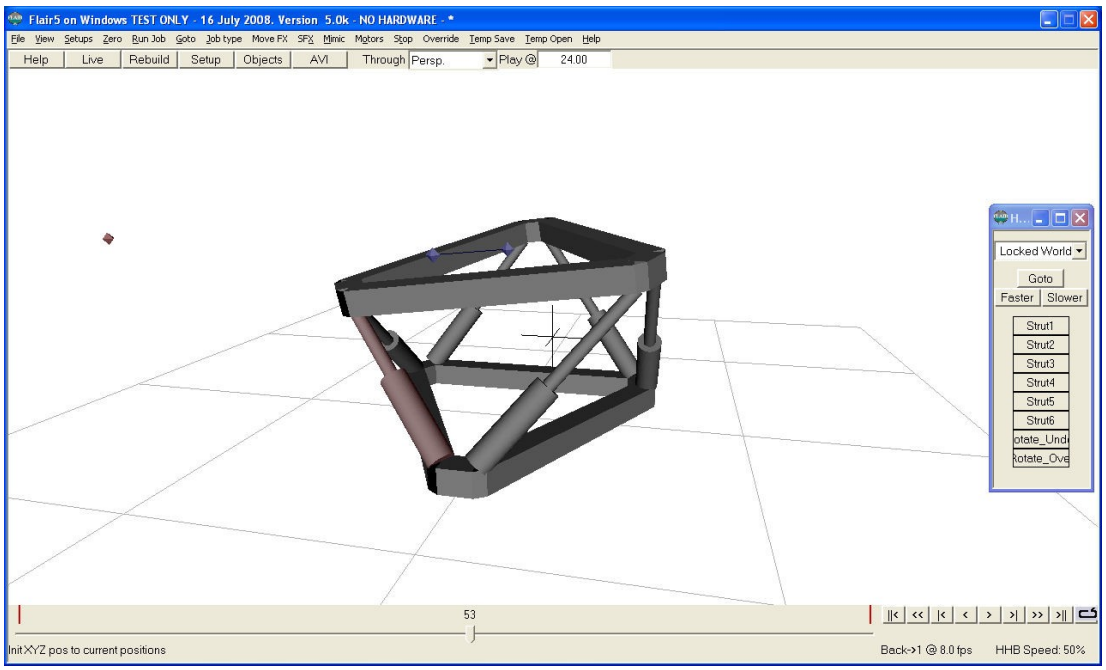
Head Angle: This is the angle that the head has been mounted at to the end of the arm. It is normally 0, but when the head is tipped, it will change in multiples of 45 degrees.

Head Order PTR, PRT: This is the order to the rotational axes on the head. Most Heads are PTR meaning Pan, then Tilt and then Roll. Some heads are a different order, specifically the Libra III head which has the roll axis before the tilt. In almost all cases, this should be set to PTR.

Lift Column Flag: See section below on lift models.

MotionBase:

Also know as a Stewart Platform, 6-DOF platform or a Hexapod


Flair5 on Windows TEST ONLY - 16 July 2008. Version 5.0k - NO HARDWARE - *
File View Setups Zero Run Job Goto Job type Move FX SFX Mimic Motors Stop Override Temp Save Temp Open Help
Help Live Rebuild Setup Objects AVI Through Persp. Play @ 24.00
Locked World
Goto
Faster Slower
Strut1
Strut2
Strut3
Strut4
Strut5
Strut6
53
Init XYZ pos to current positions
Back->1 @ 8.0 fps
HHB Speed: 50%

Strut 1 through 6: These are the strut axis numbers in an anti-clockwise direction starting to the left of the Xaxis looking from the top. The X axis runs forward from a point on the bottom triangle and a side on the top.

Rotate Under: The axis number of the rotator that is underneath the motion base. If there is none, select "Not Installed".

Rotate Over: The axis number of the rotate that is on top of the rotator If none, select "Not Installed".

Strut Length at zero: The length of the struts when at zero. They must all be the same.

The legs on a hexapod are arranged with 2 legs meeting at the top and at the bottom close together, and each pair of legs spaced further apart. These gaps define the structure of the rig:

Base Short Knuckle gap
Base Long Knuckle gap
Top Short Knuckle gap
Top Long Knuckle gap

Top Height @ Zero: The height of the top of the rig when the legs are at zero.

Base Height to pivot: Height from the bottom of the base to the lower pivots

Top Height from pivot: Height from the upper pivot to the top of the rig.

X offset from centre top: The offset from the centre of the rig to the "nodal point"

Y offset from centre top: Side offset to the "nodal point"

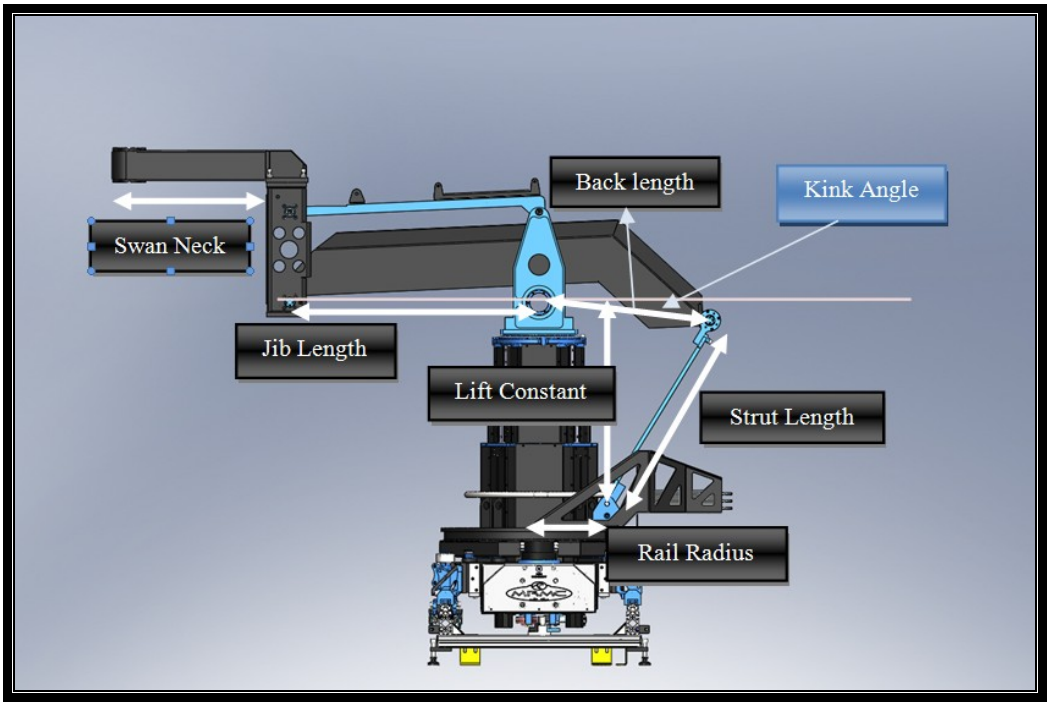
Z offset from centre top: Vertical offset from the top of the rig to the "nodal point"

Lift Models:

There are 5 basic lift models. In all cases, the lift axis raises an arm on which the camera is mounted, but in different ways. The different lift models are described here.

1)	Panther Lift	Panther Dollies (Similar to the lift mechanism on a Modular rig)
2)	Column Lift	Vertical Lift Mechanisms
3)	Strut Lift	Milos and arms lifted by a strut
4)	Angular Lift	Cyclops or angularly driven lift mechanisms.
5)	Juno Screw	Similar to the Milo but has an extra offset.
6)	Fisher Lift	Specialized lift for encoding the fisher lift using an encoder on the pivot of the arm.

Panther lift: (The model shown below is of a Modular Rig)



Lift Constant: This is the height of the lift pivot above the rotate ring when the arm is level. This is the required position for the lift zero. It is measured vertically from the arm pivot to the lower swing strut pivot.

Rail Radius: The effective radius of the rotate ring.

Strut Length: The length of the strut from the rotate ring to the back end of the arm.

Kink Angle: The angle (in radians) between the front arm and the back arm. Measure from the pivot points. Contact MRMC if you have any difficulty setting this value.

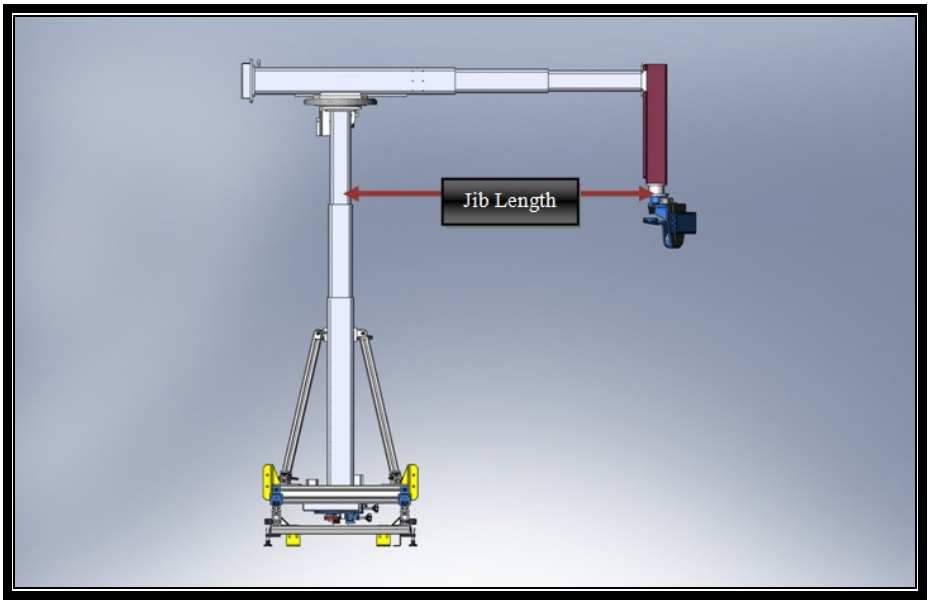
Jib Length: The length of the jib from the central pivot on the arm to the front pivot.

Back Length: The length of the arm backwards to where it connects to the strut from the main arm pivot.

Swan Neck: The length of the swan neck from the front arm pivot to the centre of the pan's rotation. This is a horizontal distance, the vertical height is a constant and does not affect the Kinematics.

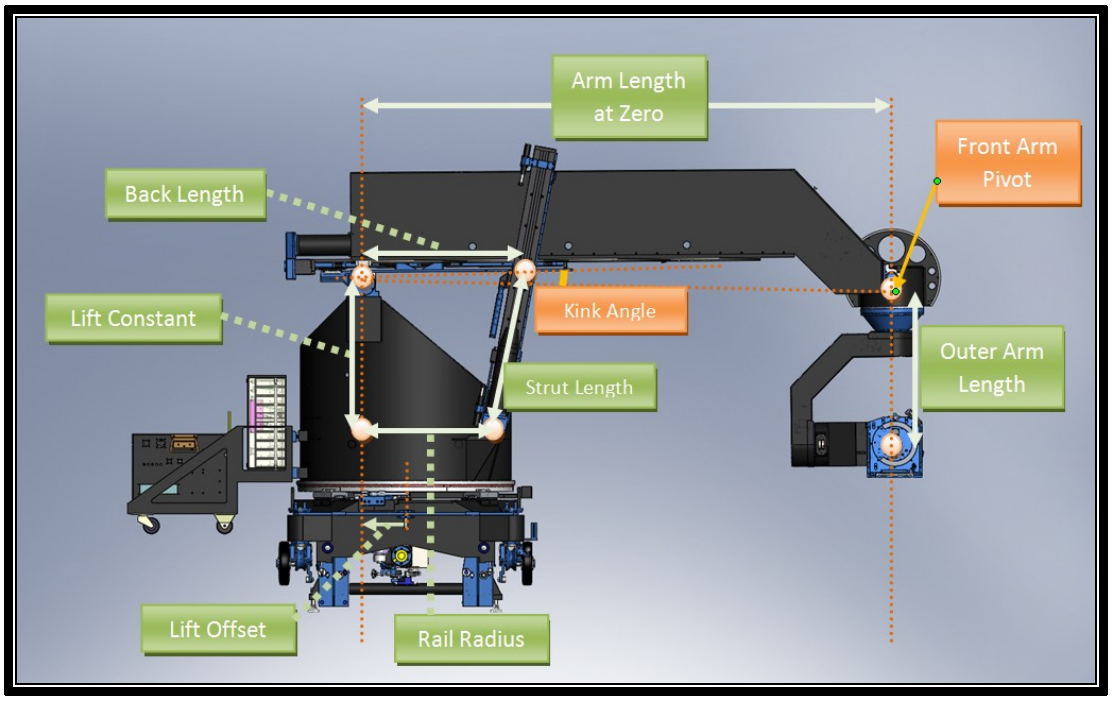
Lift Offset: The distance from the centre of rotate forward to the lift pivot. On an actual Panther Dolly this value is 0.0.

Column lift:



Lift Constant: Not needed, should be set to 0.0.
Rail Radius: Not needed, should be set to 0.0.
Strut Length: Not needed, should be set to 0.0.
Kink Angle: Not needed, should be set to 0.0.
Jib Length: The length of the jib from the centre of rotate to the centre of pan measured horizontally, vertical dimensions are irrelevant.
Back Length: Not needed, should be set to 0.0.
Swan Neck: Not needed, should be set to 0.0.
Lift Offset: The distance from the centre of rotate forward to the lift pivot.

Strut Lift:



Lift Constant: This is the height of the arm pivot above the lower lift pivot.

Rail Radius: The horizontal distance from the arm pivot to the lower lift pivot. The vertical portion of this is the Lift Constant above.

Strut Length: The length of the strut from the lower lift pivot to the upper lift pivot when the front arm is horizontal. This is the required position for the lift zero.

Kink Angle: The angle (in radians) between lines drawn from the main arm pivot to the upper lift pivot (on the strut/ball screws) and from the main arm pivot to the front arm pivot. Contact MRMC if any difficulty setting this value. This is not shown on the diagram. It is a small angle, usually a negative number like -0.04 radians on a Milo.

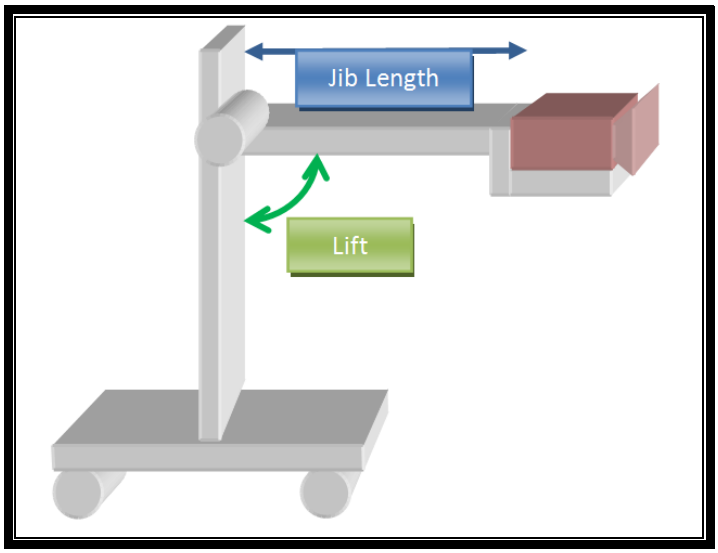
Arm Length at Zero: The length of the jib from the arm pivot to the front arm pivot.

Back Length: The length from the arm pivot to where it connects to the lift strut.

Swan Neck: The length of the swan neck from the front arm pivot to the centre of the pan's rotation. This is a horizontal distance; the vertical height is a constant and does not affect the Kinematics. This is only used for Panther systems; it does not affect Milos or Cyclops, and should be set to 0 in these cases.

Lift Offset: The distance from the centre of rotate forward to the lift pivot. With the Milo this value is usually about -0.20 and with the Cyclops it is about -0.55. This value is negative as the lift pivot is behind the centre of rotate.

Angular lift:



Lift Constant: Not needed, should be set to 0.0.
Rail Radius: Not needed, should be set to 0.0.
Strut Length: Not needed, should be set to 0.0.
Kink Angle: Not needed, should be set to 0.0.

Jib Length: The length of the jib from the centre of rotate to the pivot point for the head. Lift Zero would be when the arm is horizontal with the centre and front pivots at the same height.

Back Length: Not needed, should be set to 0.0.

Swan Neck: The length of the swan neck from the front arm pivot to the centre of the pan's rotation. This is a horizontal distance; the vertical height is a constant and does not affect the Kinematics.

Lift Offset: The distance from the centre of rotate forward to the lift pivot.

Juno Screw:
Identical to the Strut Lift except there is an offset called the Ballscrew Offset. Contact MRMC to set this value, it is not something that can easily be measured.

Fisher Lift:
The fisher lift zeroes with the front arm horizontal and that is where the arm must be when these offsets are measured.

Lift Constant: The height of the main pivot above the front pivot when the arm is horizontal. On a Fisher 11 this is 0.0

Rail Radius: This relates the slider to the front pivot and is the vertical height that a line from the slider would pass above the front pivot. On a Fisher 11 this is 0.0102

Strut Length: The length of the strut from the front of the dolly to the middle of the lift arm. On the fisher 11 this is 55mm = 0.55 m.

Kink Angle: The angle (in radians) between lines drawn from the main arm pivot to the front head pivot and the line from the main arm pivot to the slider pivot. Contact MRMC if any difficulty setting this value. It is a small angle, 0.0759 radians on a Fisher 11.

Jib Length: The length from the centre arm pivot to the front head pivot. On a Fisher 11 this is 0.64m

Back Length: The length from the arm pivot to the pivot where it connects to the slider. 0.55 same as the Back Length on a Fisher 11.

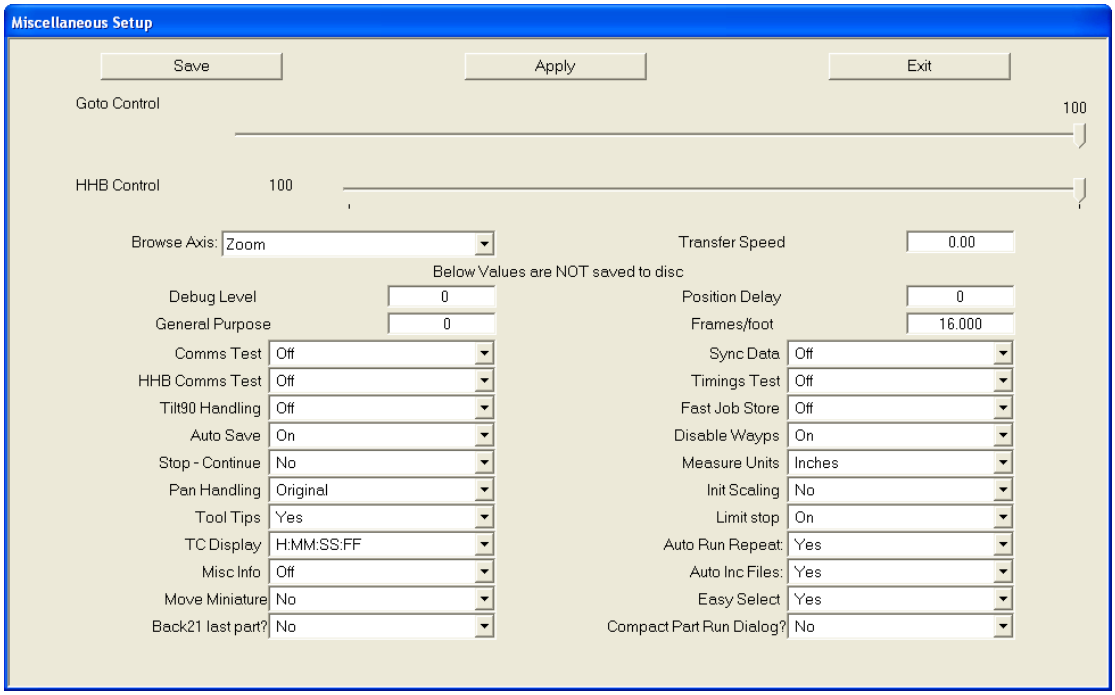
Swan Neck: The length of the swan neck from the front arm pivot to the centre of the pan's rotation. This is a horizontal distance; the vertical height is a constant and does not affect the Kinematics. In some cases this will be 0.0 if the head is mounted directly above the pivot.

Slider Angle: On the Fisher dolly, the back pivot of the arm runs on a slider mounted inside the dolly. This slider is angled from the horizontal by a small amount. On the Fisher 11 it is 0.048211radians (2.76 degrees)

Miscellaneous Set-ups

The miscellaneous Set-ups allow the user to change some miscellaneous control variables and certain Set-ups. The latter would usually only be used on instruction from MRMC. However, it is recommended that you study this section to see if any of the options are of interest and so that you can use them if needed.

The control variables that you can change are Goto Control and HHB Control. Both of these comprise a slider which will go from 1 to 100 percent. They affect the speed at which Gotos are performed and the speed at which the Hand Held Box operates. One would normally set up each axis to perform Gotos and run on the Hand Held box at acceptable speeds. If, however you were working on a small model and needed to move very slowly on the hand held box, then you can reduce the overall speed of the Hand Held Box to a fraction of its normal top speed. If you moved the slider to 50, then the hand held box would only operate at 1/2 of its normal top speed. The “Slow” and “Fast” buttons will still operate on the HHB, but in this reduced range giving you more accurate control of the rig. This is true in a similar way for the Goto Control. If you are in a tight situation and you want to be extra careful with Gotos, their speed can be reduced with the slider to make Gotos execute at a fraction of their normal speed. This is particularly useful if you are working around actors who are unfamiliar with the rig and get worried if it moves very fast.



Browse Axis: This selects which axis is designated for moving the rig through a move. The default value 0, is not recommended as this is normally the largest axis, and you do not want to move this axis when you think you are going to move along the move. A good axis to designate would be the zoom or similar.

Transfer Speed: This sets the computation that converts frames into seconds. The default value for this is 24.0 fps and so 1 second on screen is 24 frames. Regardless of the shooting speed, film is normally transferred at 24, 25, or 30 so that the times displayed on the numeric screen are not shooting time, but screen time. If this value is set to 0, then the current film speed will be used as the transfer speed.

The above 4 settings can be saved through the use of the “Save” button; however, the following are not so saved. Some of them may be set to new defaults through adjustments to the file “Flair.ini” or “FlairNT.ini”. Read the Advanced Configuration section later in this manual.

Numerical Buttons:

Debug Level: This sets the current debug level for the software and this determines how much operational information is printed out in the Flair log file. You should not normally change this unless so directed by MRMC personnel.

Position Delay: Adjusts the delay between calculating positions and sending them to the axes boards. The units are in ticks (1/50ths of a second) and this feature is used when exporting real-time XYZ data so that the video images can be processed before the rig actually arrives at the location. If you do not understand this, don’t change this value before calling MRMC.

General Purpose: This is for diagnostic purposes and should not be touched.

Frames Per Foot: This sets the speed at which the footage of film is adjusted based on the camera speed. Standard 35mm is 16 frames per foot, but 16mm is different as is vistavision etc.

Toggle Buttons:

Comms Test: Displays data on the back screen to show if the main axis pipeline is communicating OK or if there are errors. When first switched on, there will be a number of errors displayed, but none should occur after that. A very occasional error is not a problem, but numerous errors indicate a wiring problem, axis board problem or noise/grounding problem.

Sync Data: When synching to an external camera, data as to the incoming sync pulse can be printed onto the back screen using this toggle. This is not really needed now as the External Camera Set-up has a Test display which gives information as to the incoming synch pulse etc.

HHB Comms Test: Data is printed out to show if the communications to the Hand Held Box are in error or running OK. Normally a few errors are not a problem as this is not a vital process, but a high number of errors indicates noise or a wiring problem.

Timings Test: When ON, data is printed to the back screen giving an indication if the processor is handling the needed calculations in time or if it is running into problems.

Tilt90 Handling: "Off/Detect/Handle". For Tilt90 Target Tracking corrections, this has to be set to "Handle". However Tilt90 handlings are still under development and this should not be used except for tests.

Auto Save: This toggle allows you to select whether or not the computer stores the job to disk whenever it has changed and you attempt to do any kind of forward or backward run. This can save some time with rapid editing and testing of a long job, but you run the risk of not saving it before making an editing mistake or before a power failure etc.

Stop- Continue: “Yes/No/Prompt”. Whenever the stop button on the mouse is pressed during a move, the computer assumes that you would like to continue the move from the point that you stopped it. Based on this it calculates a run from the stop point to the end of the move. If you do not want this to happen automatically, select this switch to “No” If you would like to be prompted as to whether or not to continue the move, then select “Prompt”.

Measure Units: “Metres/Centimetres/Feet/Inches/FeetNinches” You can change the default value by editing the “.ini” file, but once you have loaded the software you can select between units and any currently entered values will be re-displayed. For FeetNinches, the integer part of the number is the feet (e.g. 12.06 means 12 feet) and the fractional part is 2 numbers indicating the number of inches. (e.g. 12.06 is 12 feet 6 inches, 7.02 is 7 feet and 2 inches). Please note that this does not change values already entered into any lens calibration display.

Pan Handling: “Original/Flip Tilt/Flip Pan” When you are in target tracking there are always 2 solutions to solving where the pan and tilt axes should be. If you pan, tilt

and roll through 180 degrees on each axis, the camera will be in the same position looking at the same target. Due to this, a solution needs to be chosen when it is determined that the tilt has flipped across the –90 threshold. The original handling works in many cases with occasional problems on Data Import. If you find that the camera is sort of in the right place, but looking in completely the wrong direction, then try "Flip Tilt" or "Flip Pan" and see if the problem is solved. Note that this can also occur on scaling moves.

Init Scaling: When you are scaling a move, the start position on the scaled move is often nothing like the start position of the master move. Due to this, the motor positions are not normally initialised to the start positions of the master move. When set to "On", then the scaled axis start positions will be the closest solution that can be found to the master move start positions. Please note that if you are running with the rotate beyond +- 90 degrees, then the scaled move will put the rotate back to within +-90 degrees unless you set this toggle.

Tool Tips: "No/Yes" Tool Tips are the small text boxes that appear when you position the mouse over a button and hold it there for a moment. They usually give some useful information about the button. This feature can be turned off if the user finds it to be distracting.

Limit Stop: "No/Yes" Normally when an axis hits a limit and trips out or trips out for another reason, the entire move will stop. In case this is not desired, set this switch to "No", but the recommended setting is "Yes".

TC Display: "H:MM:SS:FF/ MM:SS:FF/SS:FF" When the frame count is displayed as a timecode, the format of this data can be modified. Often, a move will not last Minutes, let alone Hours, so showing only Seconds and Frames could be desirable.

Auto Run Repeat: "No/Yes" When the system is repeat running the move, you can select whether it will automatically start each run or if you have to trigger each start.

Misc. Info: "No/Yes" Additional information about the system and its operation can be printed out as the system is running by selecting this option. It would normally only be used in conjunction with MRMC to diagnose a situation.

Auto Inc Files: "No/Yes" After a job has been stored to or retrieved from the disk and has been assigned a name, the system will automatically suggest an incremented name for the next time you save to disk. If the name of the file ends in a number before the extension (normally ".job"), then this number will be incremented. If the files does not end in a number, then a "001" will be added to the name and thereafter incremented. This can be very useful for saving different takes and not having to retype the whole name each time. This function can be turned off with this toggle, but the default state is on

Move Miniature: "No/Yes" This is a very advanced feature and is covered in the end of the Target Tracking section of the manual. This toggle basically sets whether or not a scaled miniature should simply be moved to match the master action or whether the numbers entered in its positional waypoints designate an additional motion that it should perform on top of the scaled action.

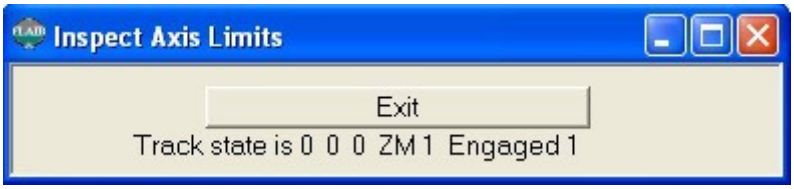
Easy Select: "No/Yes" Most of the times when there is a selectable option, a pull down menu is presented with the available options. If this switch is set to "No", then you can enter a numeric value. This might be useful for advanced or unusually features, but the default state is on.

Speed Profiling: Sets whether Speed Profiling affects the move or not, so that you can temporarily disable it.

Back 2 1 Run Again?: Allows the Back → 1 button to automatically get Ready to Shoot after moving the rig back to position 1.

Back 2 1 Last Part: This selects if the "Back 2 1" should drive the rig all the way back to the start of the move, or back to the last used start frame. It is not fully tested.

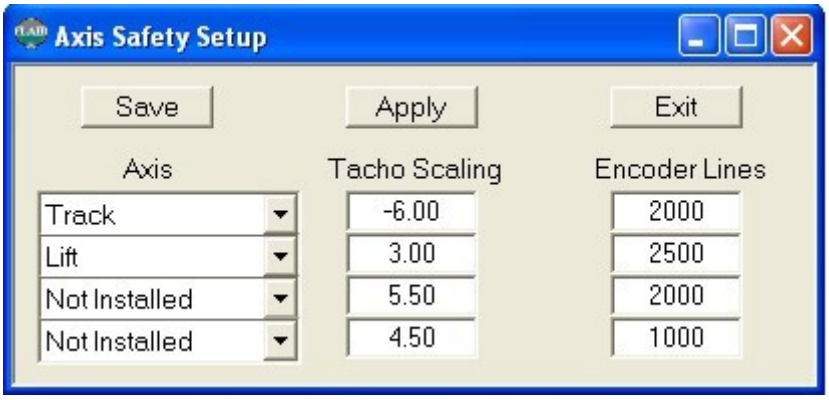
Limits Test



Each axis has 3 limits and can sense the state of the zero marker pulse on the encoder. It is occasionally useful to be able to check these to see what state they are in. When the Limit Test dialogue appears, use the mouse to click on a position box for the axis you want to test. This is any box below the axis name not the actual axis name itself; if you need to you can scroll the axes sideways using the bottom scroll bar to get to later axes. When this is done, a line will appear stating the state of the limits for that axis. The first 3 numbers are 0 or 1 and indicate the states of End Limit 1, Datum Limit 2 and End Limit 3 respectively. The number after "ZM" indicates if a zero marker pulse has been detected, and is set to 1 when there is one and 0 otherwise. The zero marker pulse is so fast you are unlikely to see this number change; its main use is to check the sense of the zero marker pulse – It should read as a "0" 99.9% of the time. The last number after "Engaged" indicated whether the axis has been engaged by the user; 0 indicates the axis is off and 1 indicates an engaged axis.

Axis Safety

The axis safety dialogue box is only applicable for users who have the Mark Roberts Motion Control Axis safety card installed on their system. This card compares the speed sensed from an axis with the intended speed of the axis on a continual basis so that if the motor turns when it should not do so, then the axis is tripped out by the safety system. This feature may be retrofitted to early systems; contact MRMC for details.



Axis: The axis to be monitored. "Not Installed" if no axis is attached to that safety port. Usually which axis has been connected will be designated by MRMC.

Tacho Scaling This is the voltage from the tacho per 1000 rpm of the motor. If the tacho is directly connected to the motor, then this figure is just the voltage constant of the tacho, if the tacho is geared, then the voltage constant has to be appropriately scaled.

Encoder Lines: The number of lines on the encoder of the axis being monitored.
If an axis that has the tacho monitor on it is detected to be moving by the program despite having been tripped, then in versions of the hardware where the e-stop can be controlled by the software, the software will drop the e-stop. This is no way relieves the operator of his responsibility of ensuring the system is safe at all times.

Saving Setups

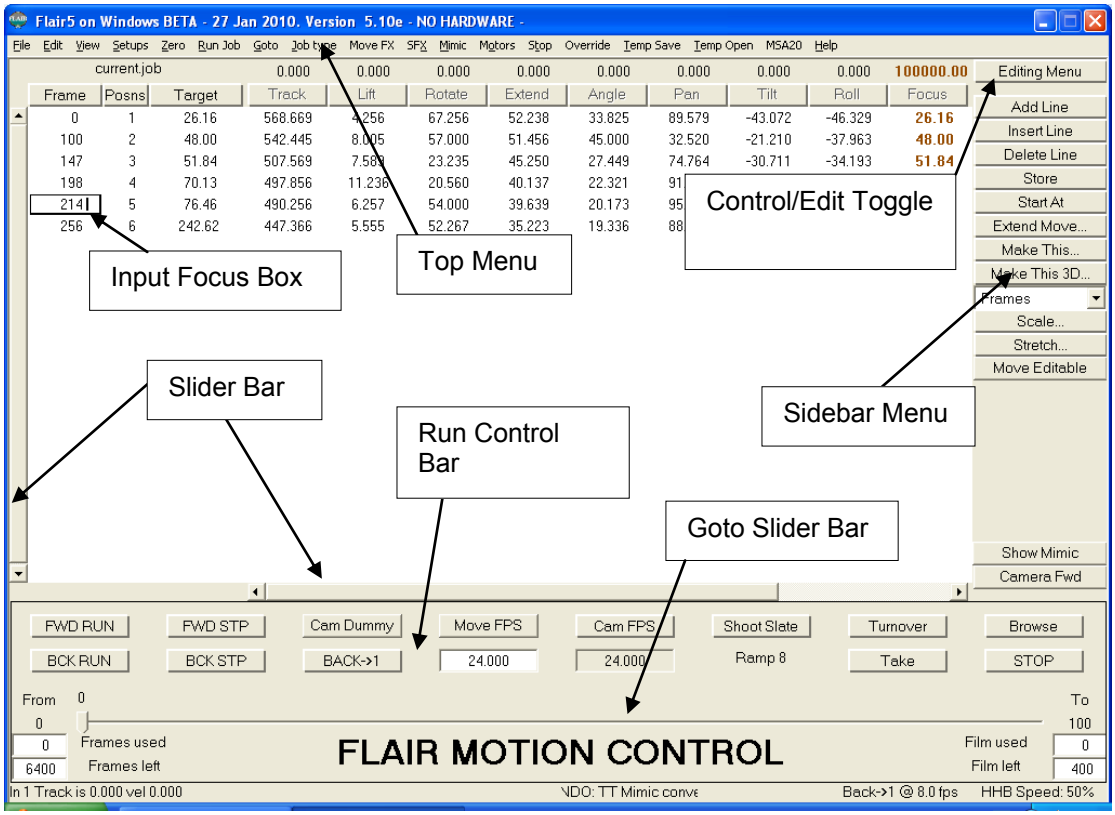
Zip Setups: Zip Setups prompts you for a file name to zip your setups into. It is a wise idea to put your company name and the date into the title of the zip file so that is can easily be identified. The files that get zipped are all the setups that define your system and this zip file will back up your system fully.

Unzip Setups: Restore setups from an archived zip file. All current settings will be replaced with the restored values.

Email Setups: Sending your setups to Mark Roberts Motion Control is very important as the software is very dependent on your configuration and many software issues can easily be resolved if MRMC has copies of your setup files. MRMC should be sent your setups when you install the system and any time you make a significant change.

CHAPTER 5 - MAIN DISPLAY

When the program first loads, you will be presented with the Main Display which is composed of the Top Menu Bar, the Numeric Display, the Side Menu Bar on the right and the Control Box at the bottom. Each part of this display is described here in turn.



Top Menu Bar:

The Top Menu Bar is composed of a row of buttons across the top of the screen, these buttons allow you to access the various features of the program and are always visible to the user.

File:

"New" deletes all existing waypoints and any data associated with them. Before actually deleting all the data, you are prompted to confirm this action. There are several selections for clearing data.

"Reset All" deletes the move as above, but also re-reads the configurations of the axes and the system from the default values stored on disk.

"Reset Warnings" re-enables any warnings that have been disabled by the user. (e.g. "Move exceeds remaining film in magazine")

“Simple Load Job”, “Simple Save Job”, “Open Job”, “Append Job”, “Save Job”, “Save As”, “Reset Job Path”
Job storage is a means of saving a job that one has run so that it can be run at a later date simply by retrieving it off disk and running it again. Further data is covered in the "Job Storage" section of this manual.

“File Backup” and “Backup Location”
Normally a Mark Roberts Motion Control system comes fully configured with the Flair software already installed for the customer. All the customer has to know about the software files is how to start the program – Flair – as in the section “Starting Flair”. However, we recommend you also make regular “datasaves” of you system and keep some copies for yourself and also regularly send copies to Mark Roberts Motion Control. Datasaves are simply copies of your configuration files and Flair program version for backup and diagnostic purposes. These datasaves are **vital** for restoring a corrupt program, copying Flair to a replacement PC (either because of PC failure or simply for PC upgrade), and reporting bugs to Mark Roberts Motion Control. The minimum that should be backed up is the configuration directory in the Flair program directory (default: C:\Program Files\Flair\Configs) and the Flair initialisation file (flair.ini), but ideally the whole Flair directory excluding actual job files should be backed up. The advantage of sending a copy to MRMC is that we have a safe copy for safety and if you report a problem it will help us diagnose to find a solution.
Flair features an Auto Backup option which can be enabled from:

File → Backup Location → Auto Backup Stored Jobs? If this box is ticked, Flair will run automatic backups of your data, periodically; Flair will additionally save any job you store to disk to the alternate backup location.

“Print” Numerous options are provided for outputting data from the system, either for permanent recording of Set-ups, or for data output into other systems such as 3D graphics machines. From this function, you can also control the destination of the data. See the section on "Data Export" for more information. The bottom button **“Debug”** provides access to a set of options which are for diagnostic purposes and do not usually concern the user during normal operation.

“CGI Import”, “CGI Export”
These will produce dialogue boxes to allow the user to import or export data between Flair and CGI systems. See the Chapter on Data Import/Export for more details.

Text Configuration Files:

It is possible to have Text configuration files to automate making minor changes in the system. These files can be viewed and edited through the software or with any standard text editor (such as Notepad or WordPad) but should not edited with an advanced word processor which might add additional unsupported characters (Only ASCII is allowed). The default file extension for such files is “.asc”, but this is not compulsory.

A typical use for this could be changing the length of the arm at Zero if you have different length arms and simultaneously reducing the Rotate Maximum acceleration as this is sometime compromised with a longer arm. It is irritating to have to change

multiple settings each time you switch out arms and setting up a simple text config file for the short arm and the long arm makes this much easier. You could also have different operators who like faster or slower settings on the hand held controls etc. Almost every setting on the axes, Camera and Kinematics can be changed through these files. You can also read multiple files in, so for example, you could read in "ShortArm.asc", then "Peter.asc" and finally "FriesCamera.asc" to set you rig up for a specific shot.

The basic format of the file is to have a title that indicates what type of configuration you are changing; this can be an Axis name, "Kinematics", "Internal_Camera", "External_Camera" or "Miscellaneous". In the lines that follow the title, the user sets variables in much the same way that they are set in the resource file ".ini" which is described in the Technical Assistance chapter. There is also an addendum in that chapter which describes all the possible variables that can be set.

"Import Text Config" and "View Text Config": will bring up a file selection dialogue box which will open in the "TextConfig" directory if that has been set through the ".ini" file or otherwise it should only in the default sub directory "configs". It will display any file with the ".asc" extension by default. Selecting "View" will bring up "Notepad" on your system if it is there and will allow you to look at and edit the file. Selecting "Import" will attempt to import the file data into your system. On any significant error, the import will abort; if a invalid data string is detected, it will be ignored and the system will continue to import valid data in the file. Errors should be reported on screen and also in the Output Log file which can be viewed through the "Help" pull down menu.
Please note that there is NO error checking on the data import other than correct format. You can set values in the system to illogical values that can cause anomalies, so please use this feature with caution.

"Update Text Config": Overwrites any values in a text config file with the current settings, allowing you to update only those fields that are required.

"Imported Files": lists the file name of the files that have been imported so you can review which config files have been read in.

"Import Camera Ramp", "Export Camera Ramp", "View Camera Ramp"
This feature allows the ramps to be imported or exported, normally for CGI use, when doing complex Camera Varispeed moves.

Edit: This menu gives you access to different UNDO options and settings. The Undo feature of the Flair software operates by storing the move state in memory when the user changes the numeric display or the positions in the graphic display. Beware that not every action is undoable and you are STRONGLY RECOMMENDED to save your data before trying to undo any action. Typically dialogue box changes are not undoable. You have the option to disable or enable the UNDO feature, as well as specify the size of the undo buffer in memory. The default number of successive action you can undo is 15.

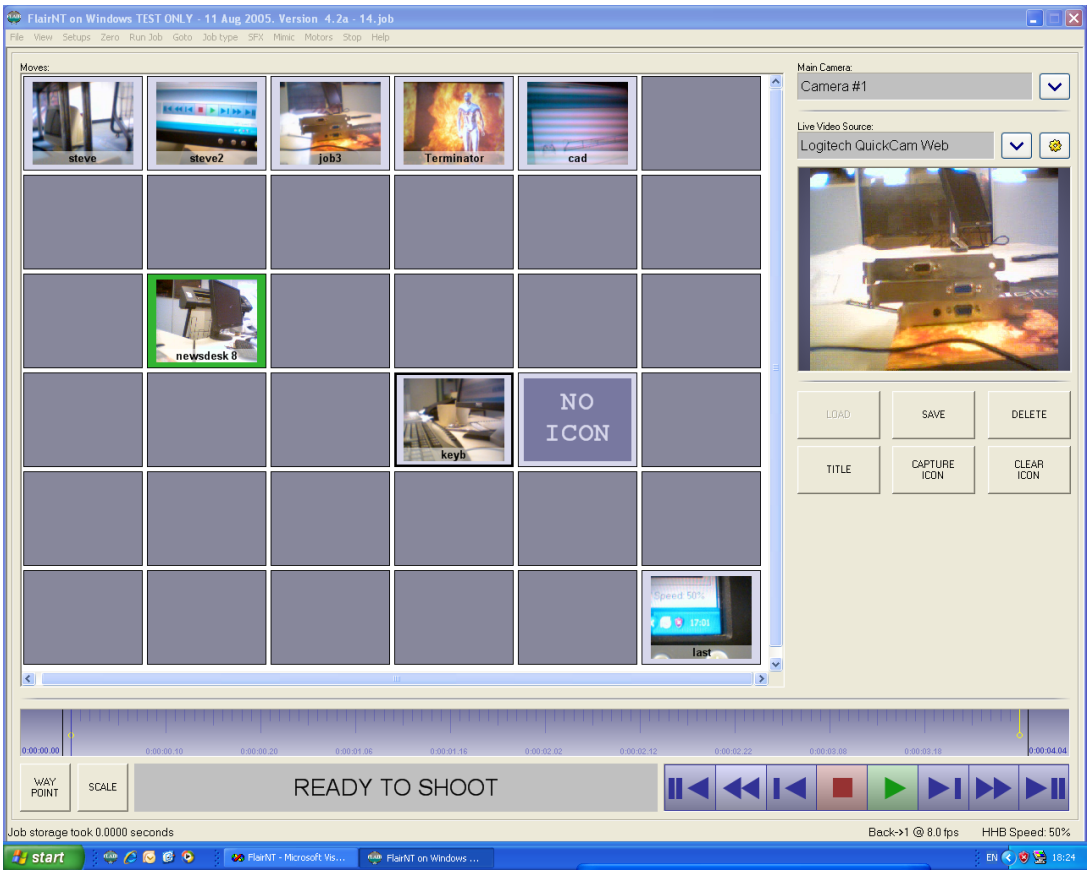
View: Pressing this button gives you several options to choose from:

"Numeric" which will display the Numeric Display as described below. The next 2 options

"Graphic" and **"Targets"** allow you to view the move graphically once it has been entered. Further information is contained in the "Target Tracking" and "Graphic Move Representation" sections of this manual. The following options "Numeric Carts" and "Graphical Carts" are for numeric and direct graphics representation of the move in terms of camera and target position. See the Chapter of Target Tracking for more data.

"Speed Profiling" with which you can affect the speed of a target tracking move without changing the curve. Consult the "Target Tracking" section of this manual for more data.
"Vary Cam Speed" allows you to vary the speed of the camera during the move - see the chapter on Variable Camera Speed. There are some "hot keys" to allow you to access these displays from the keyboard. These are listed in the pull down menu.

"Iconic" is a simple view intended for Broadcasting applications mainly with a user friendly design interface. Moves are displayed simply as images from the move and are loaded by selecting the image using a mouse. This design lends itself easily to a touch screen interface. If desired a separate appendix will be available for this display.



"Rig Model" is a view in which you can find the 3D model of the rig. It allows you to RUN and BROWSE through the move. This is very handy since you can have an idea of how the move will look like when it is executed in the real world. You can also

look through the camera and see if the rig or track is in shot. This is described more fully in the chapter “Rig Model Display”.

“Table Graph” is a graphic representation of the Lookup table. Refer to the Lookup table section under (Setups → Axis Setup → Control Tab) for more information about it.

Setups: This button allows you to access the Set-ups for the system. These are all fully described in the Set-ups section of this manual.

Zero: Zeroing axes is the way the system knows exactly where each motor is so that it can stop it from exceeding its limits of travel, and so that target tracking can work properly. Zeroing basically involves registering the position of an axis against a known reference point. Full details are covered in the "Axis Set-up" and "Zeroing" chapters of this manual.

Run Job: Allows access to options that allow you to run a job in different ways:

“Check Move” sets up the move to run and tests that there is a legal move entered, and then tests if the system can shoot the move at the requested speed. If all is OK a message stating so is produced, otherwise the user will be informed of what is wrong with the move. This is covered in detail in the chapter on running moves.

“Fwd Run” runs the job from the beginning to the end. **“Back Run”** runs the job from the end, back to the beginning.

“Part Run” allows you to run the job from any frame count within the move to any other frame count within the move.

“Timecode Run” is similar, but instead of entering frame counts, you define the start and end times by their relative timecode. This is only functional when you have a start time code selected in the Inputs Setup or on the start TC entry box at the bottom of the right hand screen menu. In this case, the time codes you type in will define how far into the move you want it to start and stop. These time codes have to be within the move, or the system will run as much as it can of the time code period you have entered.

“Repeat Run” allows you to enter how many times you would like the job to be run, and then runs the job forwards and backwards that many times - usually used for demonstration or test purposes. Entering “0” will cause the system to run the move continuously until stopped by the user.

As with the displays, also listed on the pull down pane are the hot keys which can be used to access these functions from the keyboard. Usually, F2 can be used for Forward Run, F3 for Back run and F4 for Part Run.

Goto: A "Goto" is when the user wishes to move the axes to a specific position directly, without worrying about the path of the move or any other factors. Using "Goto", the user can move the system to any specified frame count or position number simply by typing in the desired frame count or position number into a small dialogue

box, accepting the input and then pressing the "Goto" button when the system is "Ready To Goto".

The **“Goto Home”** and **“Select to Home”** options allow the user to return the entire system or selected axes to their correct home positions; this is often used at the end of the day to position the rig before shutting down.

The **“Shuttle Camera”** option will cause a window to appear which will allow the user to shuttle the camera forwards or backwards to an absolute frame count, or for a number of frames relative to the current position. To move the camera to an absolute position, type in the position required (it can be before or after the current position) and press the “Shuttle Absolute” key. To move the camera relative to its current position, enter the number of frames to be moved, positive for forwards, and negative for backwards, then press the “Shuttle Relative” button. In both cases, the user is responsible for capping the lens on the camera. The camera will shuttle at the currently set camera speed to the desired position.

“Goto Data” will display where each axis is trying to go to when the system is at **“Ready to Goto”** This is useful as it also tells you long each axis needs. If you get an unexpected Goto or a longer than expected Goto, this can be used to find out why before sending the axes off to an unknown position. The display contains buttons to execute the goto or set the system into Browse Goto mode.

“Stored Positions” There are 4 banks you can choose from: "Stored 1" to "Stored 4". These are positions of the rig which the user can store and then cause the rig to go back to at some point. The primary use of these is for positions to check zeros or for a camera loading position. These positions are NOT saved with a job and are reset when the program is reloaded.

“Preroll Extent” and **“Postroll Extent”**: If a move or section of a move starts or stops with the rig moving, then the rig will have to run on after the move, or back up to get up to speed before the move starts. The rig cannot instantly start or stop. The distance that is required to “Preroll” or “Postroll” is dependent on a number of factors, but primarily upon speed and the acceleration of the major axes involved. It is very important to know that the rig is not going to run into someone or something while it is prerolling or postrolling, and this “Goto” is to allow you to view the numerical values of the extend of the Preroll and Postroll, and also to move the rig to those positions to check that it is not going to hit anything. Use of this function does NOT absolve the operator or his responsibility for ensuring that the rig is operated in a safe manner, and any Preroll or Postroll should be tested at gradually faster and faster speeds to ensure it is OK. Please note that doubling the speed of a move will usually quadruple the Preroll/Postroll distance.

“Goto Position”, “Goto Frame” These two controls allow you to manually enter a position for the rig to go to. This position can be respectively referred to by the Position Number or Frame Number.

“Goto Closest” Goto Closest only works in Target Tracking and allows the camera to go to the nearest position on the path of the move, to where it now is. For example, if

you moved the rig with the hand controller and then wanted the camera to go back onto the programmed camera path you could use this function.

Job Type: Allows the user to change the behaviour of the system in various ways ranging from the type of curves generated to how the focus axis is controlled. See the "Job Type" section in this manual.

Move FX: Contains all the move effect that Flair allows you to apply on your current move these controls are:

Goto → Move" On occasion, the director sees a "Goto" and likes it so much he wants to shoot it. This doesn't happen often, but this feature has been added so that a simple Goto can be converted into a move and then shot as required.

"Flip Pan Arm"
With most heads, the tilt arm is on the side of the camera, and this occasionally blocks a light or restricts the motion. The same camera position can be achieved by flipping the pan, tilt and roll through 180 degrees. This function will flip the axes but leave the move the same. It is only fully operational in Target Tracking moves.

"Repeat"
Allows you to simply repeat the same programmed move again and again. For example if you repeat a 3 waypoint move 3 times you will end up with 9 waypoints on screen. If a move goes from A to B to C, there is no time defined for moving from C back to A, the user is required to enter this time in the dialogue.

"Replicate..." allows you to take an existing move or part of an existing move and repeat that move several times. Occasionally, a basic move will be plotted which you then want to repeat for several times. Rather than re-enter the lines again and again, the replicate function can be used to achieve this. You simply have to state the waypoint at the start of the section, the waypoint at the end of the section to be replicated and how many times you want to replicate it. You are strongly advised to save any move to disk before you use this feature in case it does not operate as you had intended. Any disabled axes will not have their move replicated. If you have a move that runs through a series of points say A,B,C,D. If you replicate it 2 times, the resultant move will be A,B,C,D,C,B,A,B,C,D. It walks forwards and then backwards over the move. You can also state whether you want the rig to hold at the end of each cycle by entering the length of the hold in the "Hold Frames/Cycle" box. An entry of 0 means that there will not be a hold.

"Redistribute" A move is often planned as a series of positions the camera must go through without really defining the timings. If you have set up such a move, and want the timings of the waypoints to be evenly distributed proportional to the distances between them, this button will allocate the total length of the programmed move based on those distances with a little extra time at the start and end to allow the rig to get up to speed and allow it to ramp down. This feature is only available in Target Tracking.

"Flip Move" exchanges the move end for end. Triggers associated with the move are not adjusted. Mostly used if you have programmed the move from the end to the start and would rather run the move forwards than backwards. Please note that the

positions are changed and the move re-calculated, so depending on other settings, it may not exactly match the move run forwards.

"Drop Keys" Allows the current motor position to be automatically entered into any waypoints that are disabled.

"Place Keys" Allows key-frames to automatically be generated every X number of frames based on the existing move. For example, if one wants to turn a 3 point move into a 20 point move, then this will automatically do so. Not fully functional as of Version 5.0.

"Regenerate Targets" An advanced feature for use with normal Target Tracking moves. (Does not work with PTR Target Tracking moves)
If you have a move with a target that is too close to the camera, you can get undesirable motion in the orientation of the camera as it tracks the target. This can often happen with an imported move if the CGI package has put the target too close. In this case, the system must be in Cartesian priority. One simply enters the target distance required in the "Target Column" and then regenerate targets creates new target points at the distance entered in the same line as the original one. It could also be used to bring the targets closer as needed.

SFX: (Special Effects)
See the Special Effects Chapter for a full description.

Mimic:

"Axis Mimic" and "3D Mimic":
Mimic is used to manually record axes of motion and play them back exactly as recorded. See the Mimic chapter for a full description.

"Axes Convert" This function allows any waypoint move on any axis to be converted into a "mimic" move so that there are no waypoints. This can be useful since mimic axes can be edited graphically in ways that are not possible or too difficult with a waypoint move.

"3D Convert" Does the same as above but with 3D axes (for example X, Y or Z of camera).

Motors: Enable / Disable: Causes all the active axes to be enabled or disabled one after the other. When the system is first powered up, no motors are enabled for safety. Once the system is correctly set-up, all the active axes can be enabled or disabled simply by pressing one of these buttons. All axes should be disabled when the system is turned off at the end of a shoot. The correct sequence is to disable all axes before pressing in the emergency stop switch. Of course, if there is an emergency, it is OK to press the emergency stop as quickly as you can !! If an axis has tripped out because of position loss or has been moved whilst disabled, then it cannot be re-enabled through the use of this button and has to be explicitly re-enabled by clicking on its name button on the numeric display.

Stop: Fulfils the same function as the mouse stop button, and is used to stop any ongoing action such as a move, a goto, a movement on the hand held box or even stop data output from the print menu. It is also used to get the machine out of a "Ready to" run state. When the computer has been told to run a job, it will usually go into "Ready to Shoot" or "Ready to Goto", when this happens, move entry and many other functions are inhibited. Pressing this button or the mouse stop button will return the computer to normal input mode, and data can be modified or entered.

Override: Allows the user to TEMPORARILY override the limits on an axis. There are 2 options. Override On and Override Off. The axis which is currently selected in the numeric display is affected and its limits can be turned off or back on. It should only be used in emergency situations such as a broken wire.

Temp Save: Saves the current automatically to a file named “Temp.job”. This allows a single button push to save the job before initiating a major change.

Temp Open: Restores the job last saved as “Temp.job”. If the major change didn't work out you can easily restore the system to a previously workable job.

MSA20: The “MSA20 Archiver” is a software utility developed by Mark Roberts Motion Control to interface the PC with an MSA20 Handwheels or Joystick console.

Help: This pull down menu contains a selection of items that can assist the user. These include viewing and editing the system initialisation file (Valid ONLY when the system nest loads), viewing the system output file as well as an “About” screen, recent changes list and a few extra system tools.

About: Displays data about the version of the software and its author as well as contact information.

Version Info: Displays the versions of the various pieces of software including axis boards etc. This data can be useful to ensure that the version that you expected is running. It may also be useful information for Mark Roberts Motion Control to see what features should be functional.

Version Data: This displays data about the versions of the various firmware that might be loaded onto the axis boards and what functionality is to be expected

Changes: Recent changes to the Flair software are recorded here to inform the user about recent improvements and bug fixes.

License: The Flair software requires a license to read and write jobs and to import and export CGI data. If a license is needed, the system code can be obtained from this display and sent to MRMC for an update.

Send Report: Bug reports or feature requests can be sent directly from the Flair Computer to MRMC if the machine has internet access.

Memory: Reports on the memory that is being used by the root code and also the maximum amount used during this load. This is mainly useful with the transputer

code to see is the memory limit is being approached. 1MB or 4MB depending on the hardware. The RT10 has much more available memory.

Move Info: Is used to provide some basic information about the move. It will display the time it will take to shoot a move as well as the expected screen time (depending on the transfer speed being set correctly). For Target Tracking moves, the camera motion extremes are also calculated.

Calculator: Simply brings up the system calculator.

Flair User Manual: When the "Manu" programme is installed. You can access the entire Flair Manual using this button.

Timecode Calculator: Calculations between timecode and frame counts can be quite hard and this calculator can convert to and from timecode.

Exposure Calculator: There are many factors that affect exposure and most of them are available on the exposure calculator which can work out the required stop or the required speed for a shoot compensating for the shutter angle, filters and changes in camera speed.

Units Converter: Occasionally it is helpful to convert from one unit to another and this helpful tool will do that. For example it will convert from Centimetres per second to MPH

Depth of Field Calculator: Not intended to replace the A/Cs depth of field calculations, but this handy tool is based on the standard DOF formula but also compensates as the lens moves (when in follows object/target) and also compensates for the focal length and the iris stop when these are calibrated and set up. Hyperfocal is also displayed.

View .ini File: Displays the .ini file used by the system when it boots up. As a standard this is Flair5.ini. You may also edit the file through this display. See 'Advanced Configuration' for more data.

View Output File: As Flair is running, numerous messages are generated and displayed at the bottom of the screen on the left hard side. If the debug level is increased many more messages are generated. Normally these messages scroll through too fast to be useful, so they are logged into a file as they are displayed. You can open up the file and see what messages have been sent. This is particularly useful for checking what version of the files has been loaded onto the axis boards and can also provide useful information in the event of a bug or unexpected program action.

View Load File: Each time Flair is loaded or closed down, the time and data is recorded into the "FlairLoad.txt" file. If the program closes due to Comms problems with the axis boards, this is also recorded.

View Data File: Whenever a move is saved or a move is run in record mode, this information is recorded in the "FlairData.txt" file.

Output Monitor: A scrolling window of system messages can be put on screen using this button. In some cases, you might be asked to pull this screen up in tracing down a fault or bug.

Numeric Display:

The numeric display is composed of lines containing data about frame counts and motor positions for those frame counts. Each of the these lines is called a waypoint and with each waypoint is stored a position for each axis, a frame count for that waypoint, a target distance for use with target tracking, and also any Fade Dissolve Events such as fade outs or mixes – if you have a Fade Dissolve (FDX) option.

current.job			102.393	15.600	-8.700	24.294	0.
Frame	Posns	Target	Track	Lift	Rotate	Extend	An
0	1	26.16	568.669	4.256	67.256	52.238	33.
100	2	48.00	542.445	8.005	57.000	51.456	45.
147	3	51.84	507.569	7.589	23.235	45.250	27.
198	4	70.13	497.856	11.236	20.560	40.137	22.
214	5	76.46	490.256	6.257	54.000	39.639	20.
256	6	242.62	447.366	5.555	52.267	35.223	19.

Frames Column:

The frame count column is down the left hand side of the screen, and frame count numbers are entered in here by selecting the number you want to change with the mouse so that a black square appears around it, and then typing in the new value followed by the "Enter" key. Frame counts can start at a non-zero value though this is meaningless, but they cannot reduce as you go down the screen, they must always increase.

There are several additional features provided for ease of use, and these are described here:

1) You can store the system current frame count into a line by pressing the mouse store button with the cursor over the frame count that you want to modify. This is particularly useful when you are inserting a waypoint into a move, the best way to do this is to part run the move to the frame count that you want to modify, insert a line, adjust the positions of the motors as needed, store in the current frame count of the move as above, and then store axes positions.

2) Once a series of waypoints have been added, you may want to allow more or less time between 2 waypoints this can be done by adding the increase (say 25 frames) to the frame count at the second of these points, entering that new value, and then continuing all through the move adding 25 to each frame count. If you didn't do this, the section of the move subsequent to your change would also be changed. A shortcut is to simply select the second waypoint, type in the number of frames you want to change it by, and press the "+" key to increase that and all subsequent frame counts, or press the "-" key to reduce them. This feature is called "ripple through" as the effects of any changes you make are "rippled through" the move. The standard maths features

are all available, ending any number sequence with “+”, “-”. “*”, or “\” will perform that mathematical function on all subsequent frame entries. If you entered “2*” in the first frame count position, it would double the length of the move. Since only integral numbers are allowed in the frame column to convert a frame count from 24fps to be the same time as when run ay 30fps, one could type “30*” <enter> then “24/” <enter>. Please be sure to always multiply up before you divide down.

3) When a move has been entered, the entire move can be scaled up or down to make it shorter or longer. There is a button labelled "Scale" on the Editing Side Menu Bar, and when this is pressed, a dialogue box appears prompting you to enter the new total number of frames. If your move goes from 0 to 300, you can type in 600 in this box, press OK, and the whole move and any associated waypoint frame counts will be scaled up to make the whole move last 600 frames. This is also done automatically by the computer if your move is too fast and you Apply the number of frames the computer asks for in order to shoot the move (See section under running a move).

4) The stretch feature is an extension of scale. If you want to extend or compress only part of the move, it involves both a scale of that section and a ripple through for the rest of the move. If you press the "Stretch" button on the Side Menu Bar, then you are prompted for the waypoint number of the beginning of the stretch, the waypoint number of the end of the stretch, and the desired frame count for the new end of the stretch. In this way the speed of the move through a series of waypoint can be changed without changing the timings of the rest of the move. Please note that a new curve will be generated through all the waypoints with the new times and areas outside of the “stretched” section may also be changed slightly.

Incremental Frames + Seconds Column:

The frames column by default displays absolute frames, but can be toggled to display different formats. Seconds, Incremental Frames, Incremental Seconds and Timecode. In the “Seconds” modes, the time is shown as a timecode number with the format HH:MM:SS:FF (Can be adjusted through the miscellaneous set-up to not show Hours and Minutes) The seconds values are a direct translation from the frame count entered and are converted based on the transfer speed set in the Miscellaneous Set-up. The incremental mode displays the difference in the time between waypoints (Either frames or seconds). The Timecode mode show the time of each waypoint assuming that the move starts at the starting timecode shown in the Input Set-up (“Move Start”) This would mostly be useful for Music Videos/Promos as events can be timed against the running timecode of the song.

Left clicking on the “Frames” button at the top of the column will enable the camera axis if one is configured to run as an axis in the system.

Right clicking n the “Frames” button will bring up a context menu allowing easily zeroing the camera or access the Internal and External Camera set-ups as applicable.

Positions Column:

The next column is the position number, and is to let you know which line you are on. If you have more than about 16 lines, then they will scroll up and down, and then this line numbering becomes vital. In addition, you can use this column to copy information from one line to another. Select the position box on the line which you want to be the destination line, and enter the position number of the line you want to

copy AND PRESS ENTER. Then all the data from the source line will be copied into the destination line. Any data in the destination line will be lost. If you wanted to add a hold at the end of the move, you would press "Add Line", then type in the position number of the old last line into the newly added line, and that would automatically give you a hold at the end of the move.

The position column is also used for a short hand store feature. If you press the mouse store button while the cursor is over the position column, then the current positions of the axes will be stored into this line. This allows quick data storage with minimal movement of the mouse. Keyboard entry over this column can also be used to Insert or Delete lines. When you have selected a positions number, pressing “Delete” on the keyboard will delete it, and pressing “Insert” will insert a line before the one you are currently on.

You also have the capability of disabling a waypoint so that it is not figured into the move. This is done by pressing the middle mouse button over the position you wish to disable. The buttons number should then grey out. To re-enable, simply press the middle mouse button again. This feature can be activated or de-activated through a set up in the Miscellaneous Set-ups. It is not recommended that you leave a lot of de-activated waypoints as it may confuse editing or programming the move. If it is not good - delete it, if it is - keep it.

FDX Column:

The FDX Column contains data for mixes, fades and dissolves and will only appear on your system if this option has been purchased and your camera has a fade/dissolve shutter. If you wish to program in a FDX event of some kind into the move, you must select the waypoint on which the event is to start (or create a waypoint for it to start on) and type in the event specifications. These basically consist of an alphabetic identification followed by a number that tells over how many frames the event is to occur. The first alphabetic entry is "F" for Fade, "D" for Dissolve or "M" for a Mix, the second letter is "O" for Out or "I" for In (with a mix, the second letter is automatically "x", and does not need to be typed). Then the number of frames for the event is entered. for example a Fade Out that should occur over 20 frames would look like this : "FO 20". The next waypoint must not encroach on the FDX event or an error will occur. If a box is blank, then no FDX data is contained with that waypoint. If you have an FDX event and want to remove it, select the event you wish to remove so that the black square appears around it, and then press the "Clear Field" button in the Side Menu Bar. Additional data on FDX events is given in the Special Effects Section.

Target Column:

The Target column contains the data for the Target distance while you are target tracking. This is also optional and will only occur if you have purchased Target Tracking as a part of your system. The column must be filled in for any target tracking waypoints, and target distance entered in the units specified. The units can be “Metres”, “Centimetres”, “Inches”, “Feet” or “Feet and Inches”. When a line of data is stored and the system is in Target Tracking with Focus Follows Target option selected (See Job Type Section) then a target distance will be suggested to the user based on the focus axis position. I.E. if the lens is set up and focused on 3 metres, a distance of 300 centimetres will be entered into the target column on the relevant line by the

computer. This value can be used, or ignored and overwritten. The currently used units can be changed by adjusting the setting in the Miscellaneous Set-ups.

Clicking the mouse of the actual "Target" button itself will cause a dialogue box to appear with a depth of field calculator in it. Right clicking on this button will cause the Lens Setup Display to appear for the currently selected lens.

Axis Positions Column:

The rest of the screen is filled with axis positions in vertical columns, with the axis name at the top, and a position stored in each waypoint that is registered. If there are more than about 8 axes, then the axes can be scrolled sideways so that you can get to them and study or modify their positions.

The button at the top of the column has the axis name on it. If the name is in white, it shows that the axis is disabled. If you want to enable it, click on it with the mouse and it will go black. Likewise if you want to disable it and it is black, just click on it once, and the axis will turn off and the motor will be disabled and any brake will be engaged to prevent the axis from moving. If the axis trips out for any reason (its current position read out just above the axis button will go lighter) then click it once to disable it, then again to re-enable it. If you click the mouse stop (middle) button while the cursor is on this button, the button will assume a flat look and the axis will be inactive. This means that although it will still hold position, it will not move either from the hand held box of from a programmed move. This state is the default for any axes not immediately displayed on the screen, and is useful for axes that are not involved in the move as they will not be involved in limits checking, curve generation etc.

Right clicking on the Axis Name will bring up a context menu pertinent to that axis having various options on it, including the control state for that axis as applicable. The axis can be zeroed, sent to home or a known position etc. The control mode of the focus axis for example can be switched between “Independent” and “Follows Object” or “Follows Target”

Axis positions are modified in the same way that frame counts are, simply select the number you want to change so that a black square appears around it and then type in the new value followed by "Enter". Positions can also be stored into axis position boxes simply by positioning the cursor over the relevant box and pressing the mouse store button. Positions can be deleted to leave a blank field by selecting the field and then typing the backspace delete key on the keyboard. You can modify a position and all subsequent positions for a given axis by selecting the first field to be changed and typing in the amount you want to change it by and ending this with the "+" or the "-" key to either add or subtract that amount from that entry and all subsequent entries, as the "ripple through" facility for frame counts does.

Context Menu:

A Numeric Display context menu is available if you right click anywhere on the main numeric screen where there is not a line or if you shift click on any waypoint line.
The context menu shows a couple of controls that can be easily access and a list of the actions that have been “Done” on the system and can be “Undone” If the “Undo” feature is used, this menu will show the bottom items as Redo-able and the upper

items as “Undoable”. The controls are “Auto Save” which is a switch that turns off whether the move is to be auto-saved or not and “Goto Data” which should only be used when the system is at “Ready to Goto” and which will should you the distances and times required by each axis for that Goto. “Goto Data” is also available through the top menu bar, but this is a faster way to find out why a Goto is longer or further than you anticipated.

Current Positions:

The area just above the axis name is used to display the axis current position or velocity. This display has various modes. When the number is black, it is displaying the current position of the axis in display units (for the focus, this can also be a target distance). If the axis trips out, then this number goes white to indicate that the axis is not holding position correctly and is not engaged. If a motor is tripped out, then there are 2 positions that could be of interest, one is the desired position, and the other is the actual position the motor is at. When the motor is engaged and its name is in white, then the current desired position is shown, if the motor is disengaged and its name is in white, then the user can select whether he wants the actual position of the motor to be shown or its intended position. See the section at the end of the manual in the Chapter "Technical Assistance and Errors" entitled "Advanced Configuration".

Current Velocities:

The current positions line can also be used to display the current velocity of the motor. If the number is clicked on with the mouse while pressing the SHIFT key, it will turn blue, and that will show the current velocity of the axis. If the axis trips out when it is in this mode, the number turns light blue and continues to show the current intended velocity of the axis.

Blank Entries:

If a waypoint exists, but a related box is blank, that means that no position has been stored for that axis. In fact if you simply add waypoints without storing any data, you will get entire rows of blank boxes. The boxes will stay blank until some positional information is stored in them. The significance of a blank box is exactly what you would expect, it does not hold a position, and therefore does not affect the move in any way. If you have data in a box, but want to blank it out, select the box by clicking on it, and then press the backspace delete key on the keyboard. You may not have blank entries in the frames column.

Values Displayed:

The numbers displayed in the axis positions boxes are generally in display units. When the axis is set up, it is specified what the relationship is between the motor turns, and the distance the axis moves. This means that the computer can interpret motor movement in turns or centimetres, or inches or degrees. The units that appear on the numerical screen will be in the units that the motor has been scaled for. One exception of this is the focus axis which is displayed in display units – like the other axes - when it is acting as an independent axis, but is in terms of focus target distance when the computer is controlling the focus (see Job Type Section and Target Distance data immediately above). There are other specialised axes that can display their data in other forms, but for most axes, it is simply the motor position scaled to be in workable units.

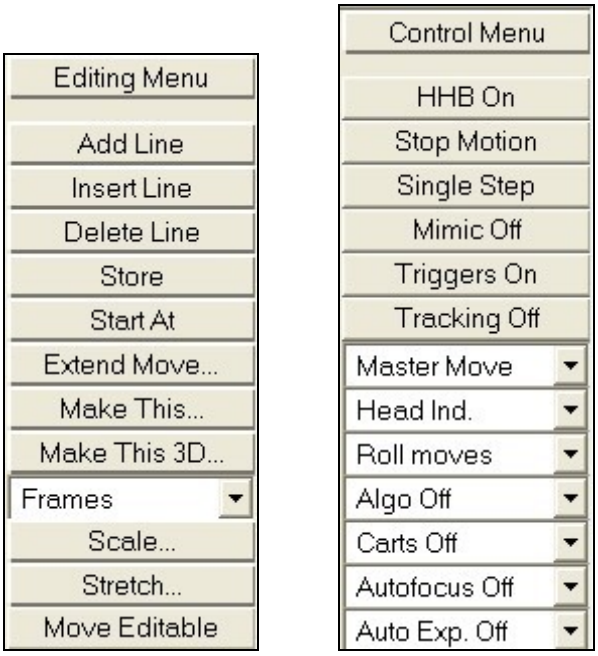
Input Focus: (The mobile black square!)
When a box on the numeric display is active a black rectangle appears around it, and when entries are made, the keys typed (if legal in that context) will appear in the black box. The black box can be moved around by selecting different boxes with the mouse, or it can be moved from one box to another by using the cursor keys on the keyboard. In addition, if you are on the last line of a job, then simply by pressing the down arrow key, you can add a new line at the end of the job. This can simplify move entry for those who are quick with a keyboard.

Slider Bars:

If your system has more than about 8 axes, there may not be sufficient room to display them all on the screen at the same time. In order to overcome this problem, the axes are displayed as data shown through a "window" and to access the later axes, you have to scroll the data underneath the window. If you click on the arrows at the right hand end of the scroll bar, or click on the scroll bar and drag it across, any hidden axes to the right are displayed. The names change to indicate that you have scrolled across, and the positional data changes. To get back to the earlier axes, simply drag the rectangular section of the scroll bar back to the left hand side, or click on the left hand arrow as needed. The vertical scroll bar fulfils a similar function, but it is for the waypoints. There is no practical limit on the number of waypoints that you can have in a job, however we would strongly recommend that you keep it under 30 otherwise navigating around the waypoints becomes very tedious and also too many waypoints too close together can often cause the move shape to develop unwanted curves. Should you have more than one screenful of data, the left hand vertical scroll bar can be used to access any data that is not immediately visible. Moves of up to 750 waypoints have been run, but this is unusual, and very slow in storing to disk.

Side Menu Bar:

Next to the numeric display on the right hand side of the screen is a vertical menu bar which is divided into 2 menu sections. The top button switches between the 2 menus that are available and they are titled "Editing Menu" and "Control Menu" As the names imply, the "Editing Menu" is related to the editing and manipulation of a job, The "Control Menu" buttons are related to how the job is run and special features. These buttons are multi state buttons and every time you click on it, it will cycle on to the next state, most of the buttons have only 2 states, but some have 3 or more. If you press the middle mouse button on one of these toggles, it will return to its default state. The function of each button is described here:



EDITING MENU

"Add Line" adds a waypoint to the end of the job no matter where you currently are in the job. This waypoint has blank axis positions, and its frame count is usually 100 more than the previous frame. (This default increment can be changed by MRMC if desired).

"Insert Line" inserts a line before the current waypoint, the current waypoint being indicated by the location of the black square on the numeric display. Like Add Line, Insert Line creates a waypoint with blank data, but the frame count is left blank. The frame count is usually set to half way between the previous and next waypoint unless the camera is part way through the move between the waypoint when the frame count will be set to the current frame count of the move.

"Delete Line" removes the current waypoint. If you delete a line, all the data associated with the line is lost. The current waypoint is indicated by the location of the black highlight square. It is a good idea to explicitly select the line you want to delete first.

"Store" takes the current axes positions for all axes and puts that data into the positions of the current waypoint. Its function is similar to using the mouse store button in the positions column except that "Store" directs the data into the current waypoint.

"Start At" allows you to modify a move to start at the current rig position but the amount of motion on each axis remains the same. This would really only be useful on linear axes such as the track. Any inactive axes are not affected by this. The action does not occur immediately, a “Confirm” box appears before the move is modified.

“Extend Move” allows you to state a frame at which you which to extend the move, and the number of frames to extend it by. Basically choose the point at which the move is going the speed you like, select this frame as the point at which to extend, then state how many more frame you want of this sort of motion. An extra line is inserted, and the subsequent positions are all increased by the extended amount. This function is experimental at this time (v4.02) and should be used with caution.

“Make This” “Make this 3D” “Make this” works in 2D and 3D and is used to offset axes of motion (real or virtual) by a specific amount. If the system is set at a frame of the move, and then the camera position is adjusted, the entire move can be offset to make the adjusted position the camera position at that frame of the move. One can select which axes are to be offset. In the virtual world, adjusting the camera without adjusting the target could have odd effects, and it is a good idea to know exactly what you are trying to do before you start using this feature, and as with any adjustment feature, one should save the job before you start. For example, if you had a move that was correct in every aspect except it needed to be adjusted up. (Say the real talent was taller than the stand in) In this case, pick a frame count where the adjustment is most crucial, and move the camera to the frame count. Then raise the camera to the desired point, and do a “Make This 3D” on the ZV and ZT axes.

“Frames” column settings: This is a pull-down list which allows you to choose what the frames column should display. The frames column by default displays absolute frames; this button can be toggled to display different formats.

"Scale..." When a move has been entered, the entire move can be scaled up or down to make it shorter or longer. When this button is pressed, a dialogue box appears prompting you to enter the new total number of frames. If your moves goes from 0 to 300, you can type in 600 in this box, press OK, and the whole move and any associated waypoint frame counts will be scaled up to make the whole move last 600 frames.

"Stretch..." The stretch feature is an extension of scale. If you want to extend or compress only part of the move, it involves both a scale of that section and a ripple through for the rest of the move. When pressed you are prompted for the waypoint number of the beginning of the stretch, the waypoint number of the end of the stretch, and the desired frame count for the end of the stretch. In this way the speed of the move through a series of waypoint can be changed without changing the timings of the rest of the move.

“Move Editable” makes the move un-editable by the user and ensures that no changes are made inadvertently. The flag should be set once you start shooting a move. The Head Control state and the Roll Control state are NOT locked as these do occasionally need to be turned on and off, as with the move speed and the camera speed. It is also possible that with diligent effort one could find another way to change the move when this flag is set, so it is an aid to the user, not a guarantee.

CONTROL MENU

“HHB Off” is a toggle button with 3 states; "HHB Off", "HHB On" and “HHB + Grips”. It defaults to HHB Off and must be explicitly turned on before you can move axes on the Hand Held Box. Its main use is to deactivate the motion functions of the Hand Held Box as a safety precaution and to allow the user to easily turn off the Grip Sticks if they provided. A right click will pull up the HHB Setup Dialogue.

"Stop Motion" is a toggle button that has 2 states, "Stop Motion" and "Moving Step". The state of this button is only relevant when you are stepping through a move (frame by frame animation). If you are in stop motion, then the exposure (Film or Video) occurs while the motors are stationary and the move occurs separately. If you are in moving step, then each forward step of the move is shot at the speed that it would occur at if you ran the whole move continuously. This allows animation sequences to have motion blur and avoids the strobing effect that can occur with stop motion animation. Note that Moving Step will only work if the move can be shot continuously at the programmed camera speed.

"Single Step" is a toggle button that has 2 states; "Single Step" and "Continuous Step". The state of this toggle is only relevant when you are stepping through a move. When in single step, every step requires you to push a button to trigger it, when you are in continuous step, the steps will occur automatically one after the other until you stop it, or the move ends. You can also turn off Continuous Stepping by pressing this button while it is shooting, the button will change back to "Single Step" and the current step will complete, and the system will stop in a state ready to continue.

"Mimic Off" is a toggle between when you are learning a mimic pass "Mimic Learn" and replaying one already learnt "Mimic Off". The name "Mimic Off" is the default state and is really mimic replay when axes are selected to mimic. There is a third option called "Mimic Learn+" which is explained in the Mimic Chapter.

“Triggers On” Triggers On/Off just allows you to set if the output triggers will come on during a move or not. Very useful if your triggers are connected to fireworks and you want to check the move is OK without triggering anything accidentally.

“Tracking Off" simply toggles the target tracking switch on and off. The toggle is only active while the move in being input and cannot be changed at run time. For more information, and the other states of this toggle see the Chapter on Target Tracking. If you have not purchased the target tracking option, this button will not appear on your system. A right click will pull up the Kinematics Setup Dialogue

"Master Move" when you are shooting a Target Tracking move, you can also scale this move up or down in size and shift it around in space. When you are doing this, you can either run the main move (Master Move) or the scaled and shifted move (Slave Move). For more information on these and the other available options see the chapter on Target Tracking.

"Head Ind." With Mark Roberts Motion Control "Milo"s and "Cyclops"s there is an additional axis which is used to swing the head over the top of the arm, giving you more reach. The axis is referred to as the "head" axis, the "angle" axis or the "outer arm" axis. This axis can operate as a normal independent axis or it can be computer

controlled to act relative to the arm. The other options on this list are "Head Level" in which case it will act to keep the axis of pan vertical, "Head Ninety" in which case it will keep the axis of pan horizontal, "Head Cranp" which is developmental and should not be used except under direct instruction from Mark Roberts Motion Control, and "Head Up" which will keep the head vertical but pointing up during the move (The range of movement may be restricted in this mode depending on the construction of the rig.).

"Roll Moves" With the "Angle" axis swinging the head over the top of the arm, if you are panned to one side, this will result in a roll motion. This roll motion may not be desirable, so the computer can compensate for this action to keep the horizon level ("Roll Level"). This of course is fine unless you want to be able to add some roll motion to the move. In this case, the selection "Roll Relative" allows you to program roll motion that is relative to the horizon rather than being relative to the zero position of the roll axis; so regardless of action that the roll motor is doing to compensate for the angle axis, the roll will also move clockwise and anticlockwise as you have programmed. Please note that in "Head Level" this function is irrelevant and should be left as "Roll Moves". In roll relative, the roll axis positions are displayed in Green to indicate that they are not true axis motor positions. When you have the roll being controlled in this way, you may not zero or home any of the axes that affect its positions (i.e. Lift, Angle, Tilt, Pan), you must first take it out of roll control to do this. If the roll trips out or it turned off when in "Roll Level", then when it is switched back on, it will request a "Goto" to the level position. "Roll Up" is a third option which is only valid in normal Target Tracking moves. It avoids the problem of looking at the floor and ceiling when there is no horizon, it basically assigns a point that defines where "up" is and moves the roll axis to follow that as it moves.

"Algo Off" Algorithmic control links the motion of one axis to the motion of the controlling axis. This is normally done through a look up table which is defined in the Axis Set-up of the controlled axis. Once the relationship has been defined, the controlled axis must be selected as a Mimic Controlled axis, and then Algorithmic control is turned on. This will normally result in a "Goto" to place the controlled axis in the correct start position, and it will thereafter be slaved to the controlling axis.

"Carts Off" The options for this are "Cart World", "Carts View", "Locked World", "Locked View", "Carts Roll" and "Locked Roll". These options are fully explained in the section "Cartesian Control" in the Target Tracking chapter of the manual.

"Autofocus Off" If your system is an animation stand that has been configured to focus on the table as the camera moves up and down, you switch the lens into follow focus using this switch. Once the lens is set-up as covered in the Lens Set-up section, turning on this toggle will normally cause the system to prompt you with a Goto that will move the lens and camera into a focussed position, thereafter, as the camera is moved up and down, the focus will be adjusted to stay sharp on the table.

The various options that control the rig in a special mode - Head Control, Roll Control, Cartesian Control etc, are selected by choosing the state you want. When this is done, either the control function will be activated, or a Goto will be required, and once the Goto is finished, the control function will be activated. If the Goto is interrupted or for some reason the control state is not activated, the label will switch back to reflect this. Only one should be selected at a time, and once its "Goto" is

finished, another option can be chosen. Please note that if you are in "Keep Head Level", it makes no sense to use any of the roll controls as the roll will automatically behave normally in this case.

Lower Control Menu

There will be a series of buttons at the bottom of the right hand menu bar which control a variety of function in the system. The exact buttons depend on the configuration of your system.

Timecode: If you have a timecode reader configured to operate with your system, then you will be able to see the current time code and the move start timecode displayed. The “Curr.” Entry is the currently read timecode and is not editable. The “Start” entry is the currently set start time of the move. It is set by using the Inputs Set-up display or by directly entering a number into the box. You can either right click with the mouse to set the current “Curr.” Timecode into the box or you can type the timecode number into the box (You do not need to type the “:”s).

Show Mimic: This button puts up a fully featured mimic control screen over the normal numeric display leaving just the top 3 positional lines exposed. This display makes it easy to switch axes into and out of mimic and is fully explained in the Chapter on Mimic. When this display is shown, the normal Mimic Off/Learn button is disabled.

Cap Open/Cap Closed: This button controls and shows the state of the capping shutter if so configured. You can operate it manually, or set it to operate automatically when you are single framing (See Chapter of Set-ups – Internal Camera section).

View Pos/Take Pos: Older animation cameras used to be able to be racked out of the way of the lens so that you could look through the lens, or project through the lens. Though not much used nowadays, this switch allows you to move the camera between the “View” and “Take positions. You do not normally take frames in the View Position, and a warning will appear if you try.

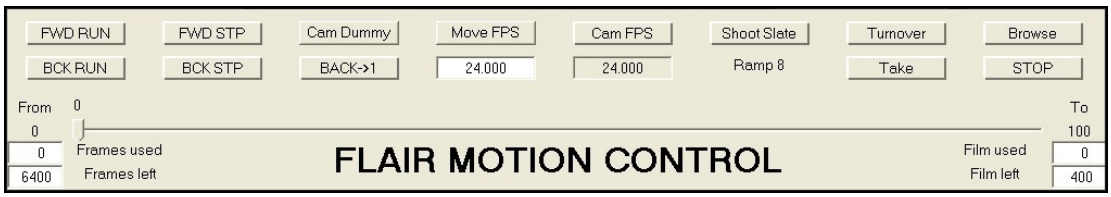
TUs Tensioned/TUs Slack: If electronically controlled take ups are part of your system, this toggle allows you to turn them on and off for reloading film etc. If you try to run the camera when the take ups are turned off, an error message will appear.

Camera Fwd/Camera Reverse: This button controls the direction the camera will run completely independent of the move direction. Cameras are usually only run

forwards except when doing in-camera effects. If you have electronically controlled take-ups, this toggle will also change the tensions on the film feed and take up sides.

Control Box:

The Control box occupies the bottom section of the screen and contains a message area and a large slider bar as well as a few other boxes. The Message area starts out by stating “Flair Motion Control” and thereafter is used to tell you what the status of the system is. There are a number of status messages that vary from "Printing" and "Shooting" to "Going To". When the message states "Flair Motion Control", you are at input, the hand held box should operate, and you can enter moves etc. In most other cases the message will be related to a move e.g. "Ready to Shoot" etc. and user input will be restricted. To return to input mode, the mouse stop button or the Top Menu Bar "STOP" button can be used.



Move Slider Bar:

The slider bar is used to show the current position of the system in relation to the move. When a move is run, the slider bar moves across informing the user where he is in the move. When the move has completed the slider bar marker stays at the last location that the system ran to. You can also use this bar to move the system around the move, simply click on the marker, drag it to where you want to go to and release, the system will then do a "Move To" to that frame count. Clicking in the slider bar on one or other side of the index pointer will cause the system to move to a frame count 1 frame before or after depending on which side of the index pointer you click. This can be useful for inching through a move, but do not click when the system is in a run state as the results are unpredictable. Do NOT click and hold down the mouse in the slider bar as this will be interpreted as a large number of separate clicks and the system will go into a continuous stepping mode which is hard to get it out of. The number of frames that you step through the move in this way can be changed by setting the number of “Frames per Step”; see the "Special Effects" section of this manual for more data.

At each end of the slider bar are small output boxes titled "From" and "To". These inform the user of the start and end frame counts of the move as it is being run.

Frames and Footage Counters:

In the bottom left and right hand corners are frame and footage counter boxes which are used to show how much film has been used, and how much remains. They do not appear on a video system. When you turn on the system, it considers that you start with a full 400 foot magazine of film, and therefore you have 6400 frames to shoot. If this is not right, you can enter the number of feet you have into the "Feet Left" box and the "Frames Left" will automatically be updated to match. If you instruct the computer to run a move that it thinks will use up all the existing film, it will issue you with a warning to that effect. This is only a warning, and the move can be shot if needed. This can also be used if you reverse load the film, simply state that you have

used 400 feet, and that there is 0 feet left. The system assumes that there are 16 frames per foot, this can be modified if needed, and is covered in the Miscellaneous Set-ups section.

The Control Box is used to control the operation of the recording mechanism and is also used to actually shoot the job. The box differs slightly between a film system and a video system, but the top row of buttons is common to both and is described next. The rest of the box is described separately for a video system and for a film system. In each case the complete box is described, though not all features may be available on your system.

Main Buttons:

The top row of buttons on this box allows you to shoot the move, goto a start position or other position in the move or step through it.

FWD RUN/GOTO/SHOOT: This button normally says “FWD RUN”, but when the system is ready to go to a position, it says “GOTO”, and when the system is ready to run is says “SHOOT”. These three functions are all combined into one button to increase ease of use.

BCK RUN: Used to run the move from the end to the beginning. The camera direction is independent of this.

FWD STP: Only valid when the system status is "Ready to Shoot" or "Ready to Step", and when pressed under these conditions, the system will step through the move by one step. Stepping is a whole subject in itself and is more fully described in the chapter "Running a Move".

BCK STP: This operates exactly like "Fwd Stp" except for the obvious difference that it steps backwards.

BACK→1: Runs the move backwards at slower speed and automatically turns the camera off. This is used for shooting repeat passes without having to turn the camera off or reduce the speed of the move. It is only valid when you are at the exact end of the move. The move will normally be run backwards at 1/3 of the camera speed, but you can set the run back speed by setting the camera speed to the runback speed you want and then using the mouse store button (Right Hand Button) over the “Back→1” button. A message will appear telling you what the run back speed has been set to. Please note that the output triggers will NOT fire during a "Back to 1". Also note that this runs the move back to the start along the move path and is different than a Goto which would not run the camera along the move path.

Camera Dummy/Camera Record: This button is a toggle that sets the move to be a dummy shoot or a recorded shoot. When in "Dummy", the whole move will be executed but the camera will not run. When this is changed to "Record", the move will be shot with the camera rolling. If the system camera is off (i.e. disabled) and External Camera is ON, then the move will be shot synchronising to the External Camera. If you are running an internal camera, then this button is active during the run and can be used to start and stop the camera running during the move as long as the

camera and move are both being run forwards. (Do not try this is you are running a variable camera speed move of any kind)

Move FPS: This is the move speed in frames per second. Any positive value can be entered into the box below this button up to the maximum speed of the camera and down to 0.001. The default values of this can be changed if needed by MRMC, but otherwise it will usually be set to 25.00. This button has an additional function when you are running a move with a varying camera speed - see the chapter on Variable Camera Speed for details.

Cam FPS: This is the speed the camera will run during the move. Most of the time, the camera speed will be set to the move speed, and if you change the move speed, then this value will change accordingly. Occasionally, you want to run the camera at a different speed to the move. This occurs occasionally, but please note that moves shot with different camera speeds, but the same move speed will NOT match. If you wish to change the speed of the move and the camera, simply enter the desired speed in the "Move FPS" entry box. A right click in this box will copy the current move speed into the camera speed box. This box defaults to a disabled state to reduce the change of inadvertent changes occurring. To enable this box, click on the box above labelled "Cam FPS"

Camera Ramp Frames:

Just to the right of the speed entry box is a number which indicates how many frames of film will be exposed while the camera is ramping up to speed. If it is 0, it means you can single frame the camera, otherwise it tells you how much film will be used on the ramp up, and the ramp down will be the same length. This is in frames of film; it is not a Preroll in frames of time.

Shoot Slate: is a push button that causes the camera to expose a certain number of frames when it is pushed. It will only work when the camera is engaged and is set up to record. For more information see the sections on Running a Move and Camera Axis Set-up.

Turnover: This is a push button that sets the camera rolling at the current move speed. It can be used to shoot a hold of an inexact length or it can be used to shoot a slate (a slate is a board on which is written the take number). When pressed a second time, the camera will stop. If you are at "Ready to Shoot" and you press this button, then the camera will start rolling; if while the camera is rolling, the "Shoot" key is pressed, then the move will start in sync with the already running camera. At the end of such a move, the camera will continue running until it is stopped unless there is a post hold set, then the camera will stop after that number of frames. A running camera may also be stopped with the Mouse Stop Button.

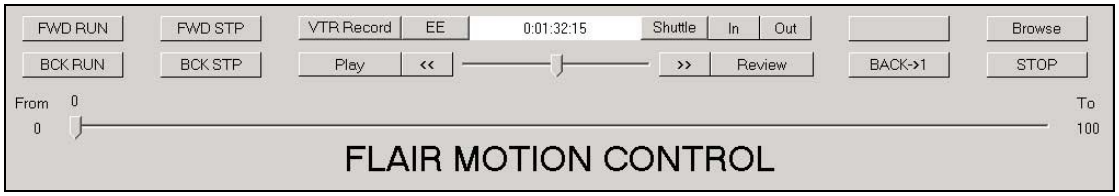
Take: The Take button will cause the camera to expose one frame at the current camera speed. If you are at a speed higher than a single frame speed, then the necessary ramp frames will also be exposed. This button does not work when you are in a run state such as "Ready to Goto" or "Ready to Shoot".

Browse: Sets the system into a mode where you can drive the rig along the path of the move slowly or fast using the hand held controller. When pressed, the system will need to move to the current frame count of the move before going into the "Browsing"

state. The current frame count is shown by the position of the slider bar. Please take note of this as it may not be where the rig is or where you expect it to be. This button will also allow you to Browse a goto. Goto can drive the rig rapidly in an unexpected fashion and should be executed with care. This button allows you to Browse the goto as if it were a normal move, allowing you gentle variable speed control over the goto. If you see a goto that is longer than you expected, it is always wise to Browse the goto rather than just execute it. If your move is very fast or has no fairings at either end, please be sure to browse the move slowly to prevent undue stress on the rig, the rig will not preroll or postroll at the ends of the move, it will just come to a stop.

Stop: Stops any ongoing action or will take the system out of a run state (e.g. "Ready to Shoot") if needed.

Video Control Box:
The control box is slightly different for a video system. It has no footage counters or camera specific buttons (Cam Speed etc), but there are extra features to allow for controlling a VTR.



Additional VTR specific buttons:

VTR Record: This is a toggle that allows you to select between "VTR Dummy", "VTR Record" and "VTR Play". In "Dummy", the VTR is not involved in running a move at all, in "Record", the move is recorded to the VTR starting at the timecode specified. In "Play", the section of the tape specified is played back in sync with the move.

EE/PB: EE means "Electronics to Electronics" and in this mode, the VTR passes the video signal through from the source to the monitor. PB means "Playback" and in this mode, you will see what is on the tape in the monitor.

Shuttle/Jog: Currently inoperative, but great things are planned ☺.
In: Causes the VTR to shuttle to the currently set record In Point.
Out: Causes the VTR to shuttle to the currently set record Out Point.
Play: Plays the VTR.
<<: Sets the record into Fast Reverse Search.
>>: Sets the record into Fast Forward Search.
Review: Causes the VTR to review the last recording made.

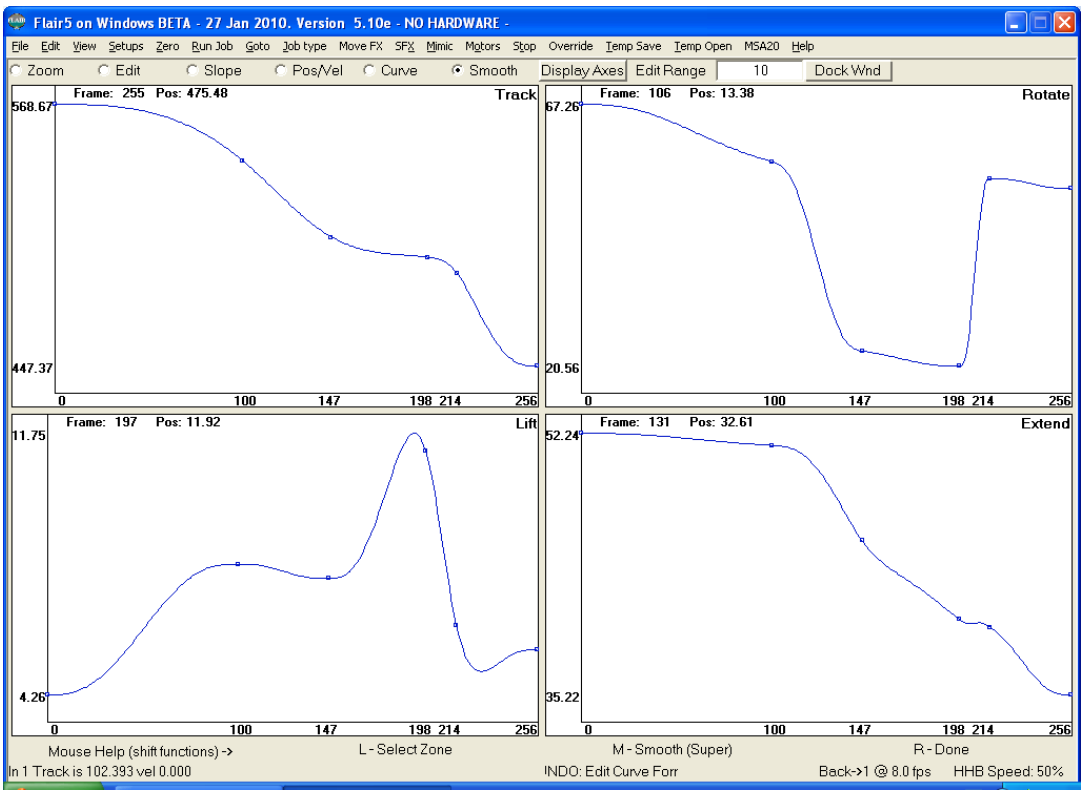
Timecode Display Window: This window shows you the current timecode that the VTR is at. It updates as you move the tapes forwards and backwards.

Shuttle Slider Bar: The shuttle slider bar allows you to shuttle the VTR forwards and backs at different speeds depending on how far you move the slider. Once released, the slider will return to the middle of the bar, and the VTR will stop.

CHAPTER 6 – GRAPHICS DISPLAY

Graphic Move Representation:

The move on any axis can be displayed on the screen as a graph of axis position against time. When the display is changed to "Graphics" by using the "Views" button on the Top Menu Bar, a variable number of graphs are displayed on the screen up to the number of axes in the system, and down to 1, along with various functions for viewing and manipulating these graphs.


Flair5 on Windows BETA - 27 Jan 2010. Version 5.10e - NO HARDWARE -
File Edit View Setups Zero Run Job Goto Job type Move FX SFX Mimic Motors Stop Override Temp Save Temp Open MSA20 Help
Zoom Edit Slope Pos/Vel Curve Smooth Display Axes Edit Range 10 Dock Wnd
Frame: 255 Pos: 475.48
Track
568.67
447.37
Frame: 106 Pos: 13.38
Rotate
67.26
20.56
Frame: 197 Pos: 11.92
Lift
11.75
4.26
Frame: 131 Pos: 32.61
Extend
52.24
35.22
0 100 147 198 214 256
Mouse Help (shift functions) ->
L - Select Zone
M - Smooth (Super)
R - Done
In 1 Track is 102.393 vel 0.000
INDO: Edit Curve Forr
Back->1 @ 8.0 fps
HHB Speed: 50%

Appearance:

Each graph displays the information relating to one axis. The graph has a title in the top right hand corner to tell you which axis it is, there is a display up the left hand side which shows the limits of travel of that axis as well as 0, if it is within the limits of travel. Along the bottom of the graph are shown the waypoint values for any waypoints occurring within the limits displayed by that graph. Each waypoint for that axis which is within the area displayed is shown as a small square, and the axis path is shown as a solid line. When the cursor is within the window of a graph, its position in terms of frame counts and axis position is shown in the top left hand corner to allow accurate inspection and editing of the graph.

Control Buttons:

At the top of the graphics display is a row of "Radio Buttons" and a single push button. (Radio buttons are like the old frequency select buttons on radios, when you press one, any others are automatically de-selected). The currently selected radio button shows the current function of the mouse while you are in the graphics display,

with a help bar displayed at the bottom of screen to show what each button does. The Radio button functions operate as follows with a separate description for the function of each mouse button, listed Left, Middle and Right

The push button, labelled "Display Axes" allows you to add extra graphs of any axes that are not displayed

Zoom :

L- Zoom: When this is the selected radio button, you can zoom in on an area of a graph if you wish to look at one section of the move more closely. Decide which area you want to look at, position the mouse in the top left hand corner of this area, depress the mouse select button and drag the cursor down to the bottom right hand corner of the area you wish to view, and then release it. As you do this, a moving rectangle will appear to show what area you are going to zoom into. Once the button is released, the section of the move you have selected will be zoomed into. In order to return to the full display, simply double click the left hand select button of the mouse in the graph you want to reset.

M- Rmv Graph: This will cause the graph you are on to be removed from the display. This is useful for looking more closely at other graphs. It may be re-added with the “Display Axes” button.

R- Flip Screen: This will cause the graph you are on to be displayed on its own, thus facilitating inspection of one axis. Pressing the button again will return you to be previous set of graphs.

In the Zoom Mode, you can also use the “Alt” key and the mouse to Zoom and Pan on the screen. “Alt” and middle button allows you to pan the graph about, and “Alt” and middle and right hand button does a zoom/un-zoom by moving the mouse horizontally. This is very similar to the Maya™ system, and is most useable with the standalone (no hardware) version of the software when this action is done real-time as you drag the mouse.

Edit Graph:

L- Move Waypoint: When Edit graph is selected, the mouse can be used to edit or change the move. Simply position the mouse close to the waypoint you wish to change, depress the mouse select button and drag the mouse up or down; a small square will appear which will travel up and down in a straight line (only the position changes, not the time). When you release the button, the waypoint that you chose will be changed to the new position you have selected, the move will be modified, and the graph redrawn to show the new move. You will actually be changing the numerical value of the axis position in that waypoint, and if you look at the move again in the numeric display, you will see that the number has changed.
If the axis movement you are looking at is a mimic recorded move, the operation of the “Edit Graph” button is somewhat different, see the later section on “Edit Range”

M- Delete Waypoint: When the middle button is depressed, the closest waypoint to the mouse cursor will be deleted, unless that waypoint is the first or last. On the numeric display, the entered value at that waypoint will be blanked out.

R- Add Waypoint. Causes a position to be added at the mouse cursor's current position and time. In the numeric display this will be represented as a blank line with a position for only the axis whose graph you were in.
Tip for editing graphs: As with entering a move, the best way to achieve the shape you want is to modify the existing waypoints, not to add lots of points.

Posn/Vel: Each graph can also show velocity against time. When this button is active, any graph selected can show three possible display states. (Position only, Velocity Only or Position and Velocity). The scale down the left hand side is the position scale only. The velocity profile for the move will only be correctly displayed once the move has been calculated with a Forward Run or a Back Run. If the velocity graph is not wholly displayed on the graph, then simply cause the move to be fully calculated, and the graph will be correctly scaled. (You can cause the move to be calculated by pressing forward run, and then "STOP", you do not need to actually run it). You cannot edit the velocity graph directly.
L- Posn: Causes the position only to be displayed
M- Posn & Vel: causes both the position and the velocity to be shown on the graph.
R- Vel: causes just the velocity to be displayed.

Curve: The subject of Curve generation and curve reversal is covered fully in the Chapter on Move Entry. This should be studied in order to get an understanding of what this function does.
L- Allow Rev: When pressed near a waypoint, allows curve reversal to occur at that waypoint.
M- Stop Rev: causes curve reversal phenomena to be stopped at the closest waypoint to the mouse when clicked.

Smooth: When you have a mimic learnt move being displayed on the system, you have the option of smoothing it.
L- Select Zone: A single press allows the user to drag a box showing the range of time over which the move will be smoothed.

M- Smooth: Clicking this button causes the selected zone to be smoothed, each subsequent click smoothes the move more and more. Each smoothed graph is drawn over the top of the last graph, so you can see the effect as you smooth it. Shift Clicking in this mode will do a “Super” smooth - this means that the number of mimic sections in the selected range will be halved which has a dramatic smoothing effect and should be used cautiously.

R- Done: When clicked, the graph is redrawn showing only the smoothed path.

Display Axes: Pressing this button calls up a dialog box with every axis listed on it. If you select an axis, its graph will be added to those displayed if it is not already on the screen. You can add as many of the graphs as you like, but when there are more than 8, they become rather hard to read and use!

Edit Range: This alters the range over which a graph is altered when the data is recorded as a mimic move or discrete samples rather than as curves. See the chapter on Mimic for more data on this.

Dock Wnd: This feature allows you to "tear off" the graphics display as a separate window. This is only really useful if you have a dual monitor display and then any of the main graphics windows can be docked or undocked. When undocked, then the move can be run and the graphics display will have some indication of the motion of the move as you go. This can be very helpful in fine tuning the editing of the move and is not available when the window is docked. The window may be docked again by pressing this button a second time.

CHAPTER 7 - MOVE ENTRY

Moving the Motors:

Engaging a motor:

When the system is first powered up, no motors are engaged, the user has to engage them. The first thing to do is to turn on the power to the amplifiers by letting out the red emergency stop button and pressing the e-stop reset button if supplied. The state of a motor is indicated by the colour of its axis name near the top of the numeric display, and by the colour of its "current position" which is directly above. If the axis name is white, that indicates that it has not been enabled - simply click on the axis name, and it should go black indicating that the user has enabled the motor and wants it to be engaged. If this is successful, then the current position, which was also white, will go black. The motors can also be enabled all together if the button "Motor → Enables" on the Top Menu Bar is pressed. This function takes no account of the current state of the motors, and if you have enabled them individually, then pressing this button will have no effect.

Manual Movements:

Once the motor is engaged and under power it may be moved on the hand held box, simply move the joystick, or push the button associated with that axis, and it will move. If a motor will not enable (i.e. its name stays white) then you are probably in a run state and your request is being refused. If a motor enables, but does not engage, numbers stay white then the axis has hit a limit or is not properly connected - check the cables to the motor and try again.

Velocity Readouts:

As well as showing axis position you can also display the velocity of an axis at any time. Simply hold the Shift key while using the mouse to select an axis position. The axis positional readout will change to blue and any values displayed will be the current velocity of the axis in display units. Light blue indicates the axis has tripped. To change back to position readout, simply repeat the selection with the Shift key.

Mouse & Keyboard Jogging:

If Mouse Jogging has been enabled on your system, you can also individually move axes using the left and right mouse buttons. Place the cursor over the current position of the axis you want to move and depress and hold the left hand button to go positive and the right hand button to go negative. Some of the alphabetic keys may also be used to jog the first 9 axes in your system. “A” jogs axis 1 positive and “Z” jogs it negative, this continues with “S” and “X”, “D” and “C” etc. through the first 9 axes. (“Keyboard Jogging” must be enabled in your system .ini file)

Changing manual speeds:

Using the "fast" and "slow" buttons on the hand held box, you can increase and reduce the speed that a motor travels at. The behaviour of the motors when they are controlled by joysticks or the buttons on the hand held box is a function of the axis Set-up (See Axis Set-up section in the Set-ups chapter). If you find that the motor does not move as fast as you like even when you are at fast speed on the hand held box, then the Hand Held Box Velocity in the relevant axis Set-up can be changed, but

be careful not to set it too high, or you may find that fine positioning of the motor becomes impossible. The current setting is displayed on the Hand Held Box and also in the very bottom right hand corner of the screen, where it is displayed as a percentage. With mouse jogging, you can also change the Hand Held Box speed by first clicking on one of the axis current position displays and then pressing the PC keyboard "+" and "-" keys to increase and decrease it.

The hand held box is used to move the motors around so that waypoints can be plotted for the move. The positioning and plotting of these points is key to the end result of the move.

Programming a Move:

Basic law:

One of the first laws in programming a waypoint type move is to use as few waypoints as needed to achieve the path required. If you "store a point, move a little bit, store another point" and so on, you will almost invariably end up with a poor move. The best way to enter a move is to decide on the start position and plot that, then plot any VITAL mid points and then the end point in as few points as possible. Then run the move and see what happens.

Positioning Waypoints:

The best way to determine where to place a waypoint is to put it at an extreme of the movement. If you have to start far from an object, get closer and then move away, the obvious points to plot are the start and end, and a midpoint which is at the closest you want to be to the object. This has to be done with care and you have to take into account the likely path of the move to avoid any obstacles, but it is quickly learnt with practice.

Entering waypoints:

The actual entry of points is achieved by moving the motors using the hand held box to the desired position and getting the framing correct, then select the first waypoint by clicking on it with the mouse select button (left hand button), then press the "Store" button in the Side Menu Bar. Alternatively you can select the position box for the waypoint in the column labelled "Pos" with the mouse select button, and then use the mouse store button (right hand button) to store the current axis positions into that waypoint.

Adding Waypoints:

When more waypoints are wanted at the end, press "Add Line" in the Side Menu Bar, and a new line will be appended to the move, then move to the correct position for that waypoint, and repeat the storing process. Alternatively, you can cursor down from any column of the positions display (except the frame count) and a new line will be added

Inserting Waypoints:

If you wish to insert a waypoint in the middle of an existing move, then you must select the waypoint which you want the new line to be inserted before. e.g. if you have a 2 point move and you want to put a new line in between, simply select the second waypoint, and then press "Insert Line" in the Side Menu Bar. If you are going to insert a line in an existing move, the best way to do it is to position the motors to the correct

position for the intended waypoint BEFORE you insert it, then insert it and then store the positions. You can also insert a waypoint by positioning the cursor as above and pressing the “Ins” key on the keyboard.

Modifying a Move:

Once the move is entered in its basic form, you may find that it is not exactly the move you wanted. The first thing to check is that it is correct at the waypoints. If it is not, change these until it is and only start adding waypoints when you cannot effect the change you want with the existing waypoints. Adding a waypoint is best done by finding the frame at which the departure from the intended move is greatest. (you can do this by watching the move and seeing where the slider bar is when the move leaves the desired path by the most.) Then run the move to the place where it is worst, insert a waypoint at that point of the move, then correct the positions so that the correct path is more closely followed, and store the necessary positions. Then run this and continue correcting as needed to get the path right. Again, it is usually better to use fewer rather than more points.

Deleting Waypoints:

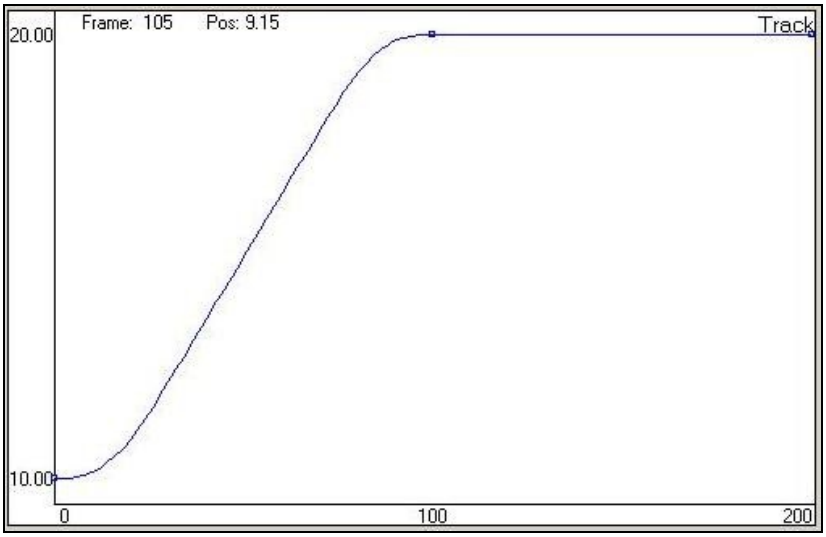
Waypoints can be deleted by selecting the line you want to delete, then pressing the “Delete Line” button on the Side Editing Menu bar or pressing the keyboard “Del” key. A waypoint may also be disabled to see if that produces the required effect before deleting it. In this case press the middle mouse button over the waypoint position number and the number should grey out. This waypoint will not be removed from the system, but will not be factored into any move. Re-enable in the same way.

Curves and Straight Line Moves:

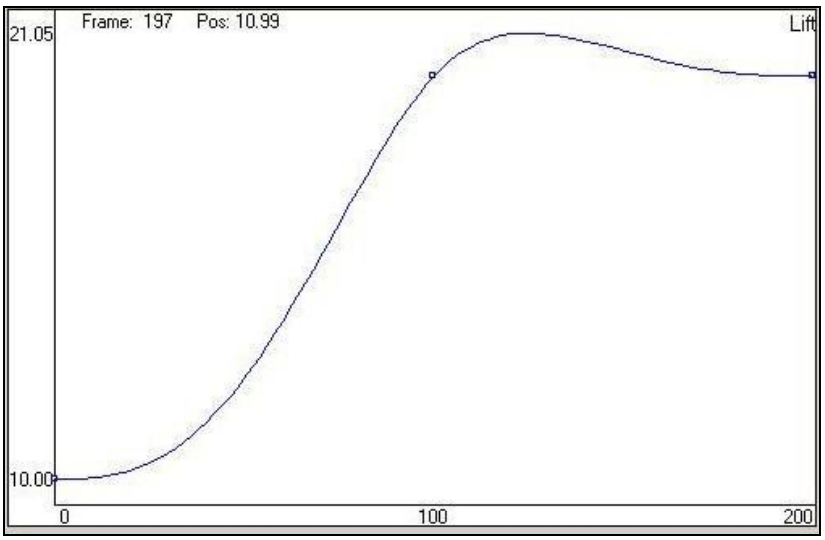
A path can either be a straight line or a curve. If you have only 2 points, then the usual path is a straight line between them, when there are more than 2 points, the path is usually a curve. When there are numerous points, the computer will calculate a smooth path that passes exactly through all the points. You usually have to have at least 3 points to create a curve.

Curve Form:

The actual behaviour of the computer curve fitting may not be exactly what you wanted; for example if you had a move followed by 2 positions exactly the same (a hold), the computer generated curve would naturally go from the first point to the second point, then overshoot it and end up at the third point. This would not be the desired effect, but it is the smoothest way to execute the move as planned. This particular occurrence can be prevented by informing the computer that 2 identical positions next to each other are a hold, and the motor is not supposed to move between them. (This is done through the Job Type Display, see the relevant section of this manual for more information).



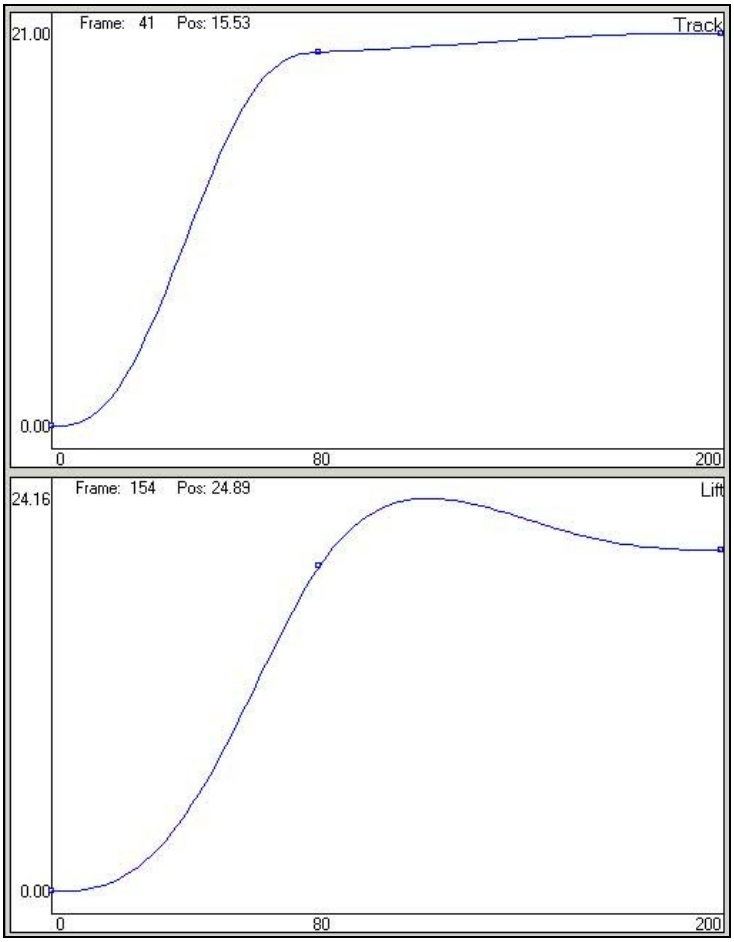
Graph showing move with “holds are still”



Graph showing same move with “holds can move”.
Notice the “curve reversal” overshoot described below.

Curve Behaviour:

The above example is rather trivial, but there are more subtle effects that have to be watched for. One particular effect has been termed "curve reversal". In our use, this term means that while moving between 2 points, an axis moves through a position that is not between the 2 points. If for example you had 3 points on the tilt, each with 50 frames between the next. The first point is 10 degrees, the next is 11 degrees, and the last is 25 degrees; since the second part of the move is much faster than the first, the natural curve would cause the motor to back up from the start to less than 10 degrees in order to get up to the required speed to carry out the second part of the move. Whilst this is the most natural and smoothest curve, it may not be what the user actually intended, and if you have a camera moving along close to a floor, and then going up fast, the natural curve would cause it to hit the floor! This phenomenon can be prevented by selecting "Prevent Curve Reversal" in the Fairings Setups or the Graphics Display.



Here is an example of a curve which reverses, and one which has been handled. The movement and timings are the same on the 2 axes, but the lift clearly exceeds its end position during the move, but has a nice smooth curve. The Track has had curve reversal handled and does not exceed its end position, but it is 2 connected moves, and is not as smooth as the lift's motion.

Curve termination:

What happens when the curve reversal handling is implemented is that the curve actually terminates at the point, and a new curve is started. If the motor has to change direction, then the curve is ended completely and the axis is taken to a complete stop at the critical point, and then it is started again. In this case you have stopped the move, and in fact can have 2 separate moves back to back, and if there are only 3 points in the entire move you have now created 2 straight line moves next to each other.

The best way to really understand this and get some reality on what happens is to read the section in this manual which describes how to use the graphical displays, and then see it for yourself.

Times and Timings:

Changing the length of a move:

The overall length of the move is given by the final frame count minus the start frame count divided by the camera speed. The way to change the length or speed of the

move is to make the move last for fewer or more frames or possibly to change the speed of the camera (This can only be done with a film system, not a video system). If you wish to scale the whole move up or down so that the basic move and relative speeds remains unchanged, then use the "Scale" button in the Side Menu Bar the operation of which is fully described under the section "Side Menu Bar" in the “Main Display”, chapter 6 of this manual.

Adjusting the timing of part of a move:

Other variations can be effected by using the "Stretch" feature which is also fully described in the above-mentioned section. The third way of adjusting the timing is to use the "Ripple Through" feature. This allows the user to change the time between 2 waypoints without affecting the others. Normally if you increase the frame count of a waypoint, you make the time between those waypoints more, but you automatically make the time to the next waypoint less, unless you add the same amount of frames to every subsequent waypoint. This is done automatically for you when you use "Ripple Through". Simply type in the number of frames you wish to change the waypoint by and press the "+" key if you want to add them, and the "-" key if you want to subtract them. The computer will then automatically modify that waypoint and all subsequent waypoints by the amount you have entered. The effect is ‘rippled through’ all later waypoints.

Fairings:

Introduction:

When you are running a move with the user defined fairings, and it is a 2 point (straight line) move, the axis will go from rest up to a constant velocity, continue at that velocity, and then ramp down to a stop. We term the ramp up as the "Up fairing", and the down ramp as the "Down fairing", or the "Start" and "End" fairings. The ramps are not linear, but change the velocity of the axis in an "S" shape, this allows a smooth acceleration or deceleration.

When fairings can be used:

A start and end fairing can be entered for between any 2 points where the motor comes to a stop at both the start and end points. So you can have fairings for any 2 point move, and for between any 2 points in a multi-point move as long as the axis comes to a complete stop at each end of the fairing. In Target Tracking the fairings can also have an effect on a move. The paths of the camera target and viewpoint will be traversed as per the fairings set for each. You cannot use a 0 fairing within a move (zero fairings have no ramps, they are a constant speed move or one that starts and stops instantly), these are ONLY valid at the very end and start of the move, otherwise you would get a pre-roll or post-roll within the move which would be meaningless, and would spoil the shot. If you have a multi-point move with the axes coming to rest within the move, you can set different fairings for each waypoint both for the independent axes and for the Target Tracking axes. Please see the Set-ups Chapter, section on Fairings Set-up for more data.

Fairing Duration:

A fairing can be as long or as short as the user wants. A fairing is often defined as a percentage of the move, and when the move is run, the respective fairing will last for the stated percentage of the move. If a fairing is stated as being of 0 length, then the axis will start or end the move at a constant velocity and will have to pre-roll or post-

roll to achieve this. A fairing can last for the entire move in which case it will be changing speed throughout the move. In the case of overlap, the fairings are truncated. e.g. if both fairing are set at 100% of the move, then the computer will cut them back each to 50%. In a section of a move with fairings, the percentage duration is the percentage of that section of the move, not the entire move duration.

Fairing Shape:

10 different fairing shapes are provided and these vary the way in which the axis gets up to speed during the fairing. These types are numbered from 0 to 9 inclusive. The lower the fairing type number, the earlier in the fairing the axis gets up to speed which means that it accelerates harder to start with and then eases off. A fairing of value 5 is approximately symmetrical and a higher number fairing starts accelerating more slowly and accelerates harder nearer the end of the fairing. Type 5 has been found to be the best in most cases, but for a better idea of how these work try it out for yourself.

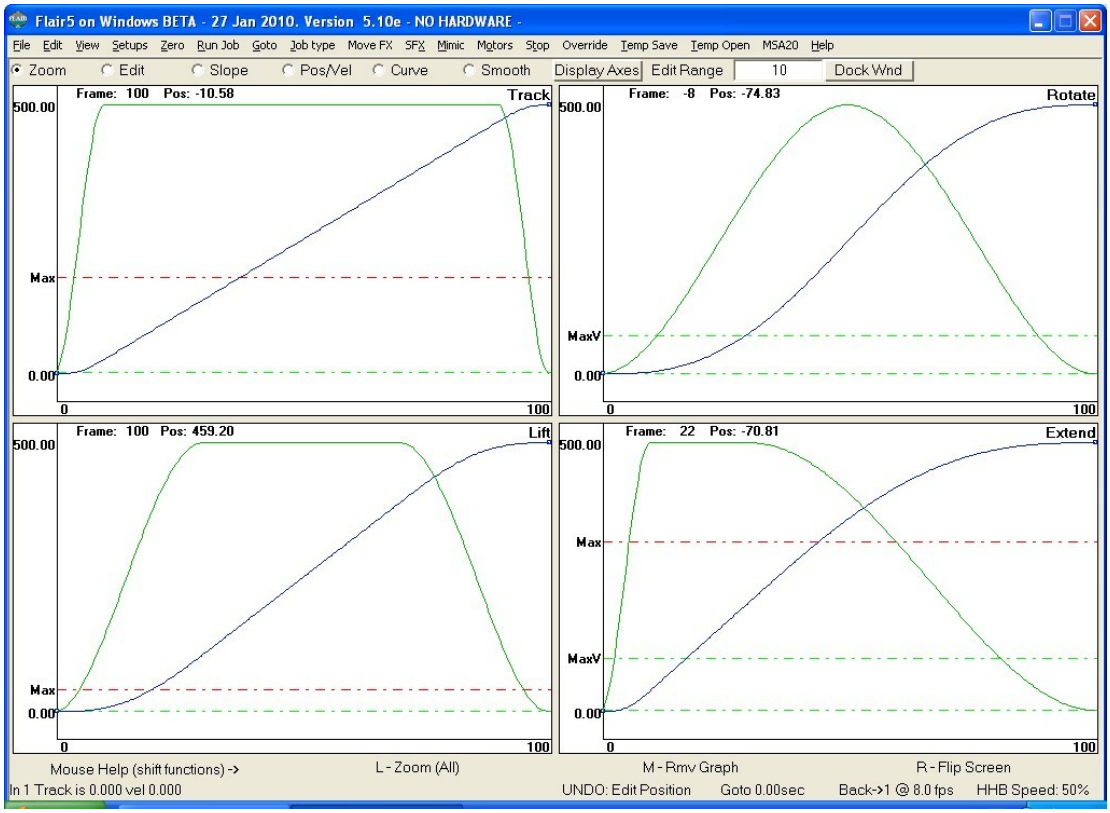

Flair5 on Windows BETA - 27 Jan 2010. Version 5.10e - NO HARDWARE -
File Edit View Setups Zero Run Job Goto Job type Move FX SFX Mimic Motors Stop Override Temp Save Temp Open MSA20 Help
Zoom Edit Slope Pos/Vel Curve Smooth Display Axes Edit Range 10 Dock Wnd
Frame: 100 Pos: -10.58
Track
Frame: -8 Pos: -74.83
Rotate
Frame: 100 Pos: 459.20
Lift
Frame: 22 Pos: -70.81
Extend
500.00
Max
MaxV
0.00
0
100
Mouse Help (shift functions) ->
L - Zoom (All)
M - Rmv Graph
R - Flip Screen
In 1 Track is 0.000 vel 0.000
UNDO: Edit Position
Goto 0.00sec
Back->1 @ 8.0 fps
HHB Speed: 50%

Diagram shows position and velocity graphs for the same two waypoints but with different fairings. Track – 10% fairings. Lift - 30% fairings. Rotate – 50% fairings. Extend – 10% up fairing, 70% down fairing.

Exponentials:

Introduction:

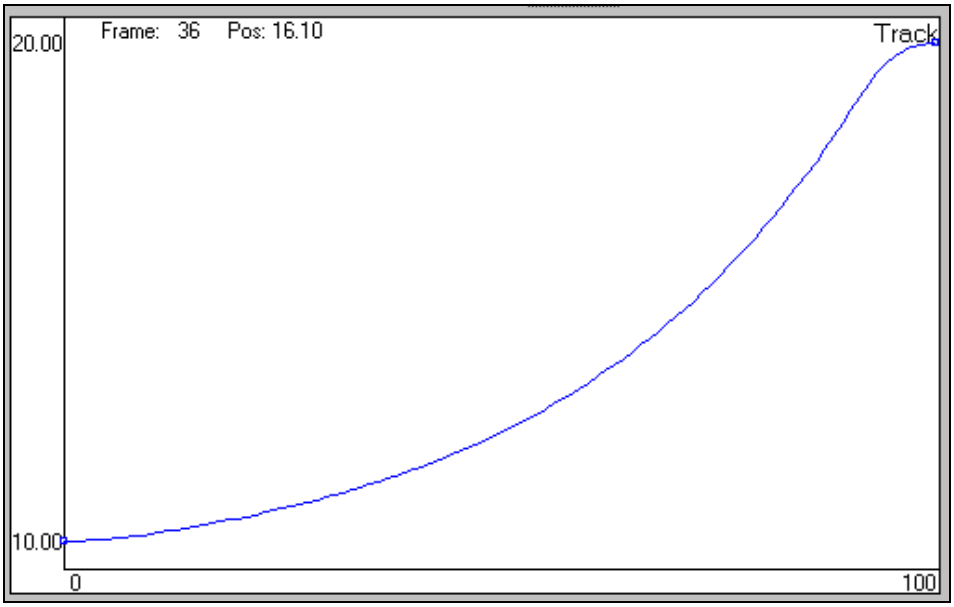
The idea of exponential moves is that you can state the ratio between the start velocity and end velocity of a move. This can be used to create unusual speed effects and also to provide a constant rate of change of field size as you pull out from an object. A normal faired move as above, has the ratio between the end and starts velocities of 1 to 1, and is a special form of exponential.

When exponentials can be used:

An exponential ratio can be entered for between any 2 points where the motor comes to a stop at both ends. So you can have an exponential for most 2 point moves, and for between any 2 points in a multi-point move as long as the axes comes to a complete stop at each end of the exponential. Exponential moves utilise fairings to start and stop, and these can be adjusted through the fairings display. The exponentials can also be used in Target Tracking. The same theory as above is applied to the speed with which the target and viewpoint traverse their paths. Note: When in Target Tracking, the values entered into the first axis are used to set the Target Tracking exponential ratios for all Target Tracking axes

How to define an exponential:

Exponentials are achieved by entering a ratio between the start and end velocities other than 1.0 to 1.0. If you enter 1.0 in both columns, the start and end velocities will be the same, and you will have a standard faired move. If you wanted to get a constant rate of change of field size on a move, you could achieve this by measuring the field size at the start, measuring the field size at the end, and entering these numbers directly into the exponential ratio for the move. See Exponential Set-ups for a more detailed description of the entry of exponential ratios.



Axis with 1:10 exponential ratio move.

CHAPTER 8 - RUNNING A MOVE

Forwards or Backwards:

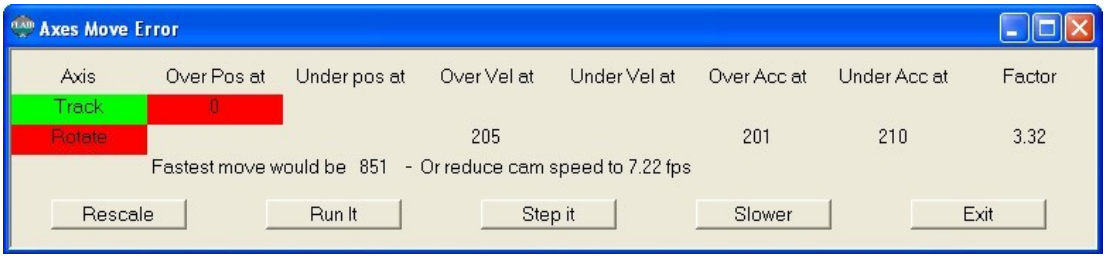
Any move once programmed can be run forwards or backwards. Press either the "Fwd Run" or "Back Run" button on the Control Box, and the computer will check that the move is complete and there is no omitted data, calculate paths for each axis and check that each axis can run the job as entered. If everything is within allowable limits, the computer will compare the axes current positions to the move start position, and if they are different, the computer will go into a state of "Ready to Goto". Once the Goto button is pressed it will then move straight to the start of the move. Once it is at the start of the move, the computer will go into the "Ready to Shoot" state, and by pressing the "Shoot" button, the move will start.

Job checking:

Before a move is calculated, it is first checked to see if it is complete. This makes sure that there are at least 2 positions, that there are times entered for the waypoints as needed, and that the frame counts increase through the job, and do not reverse. Any errors at this stage will produce an error message stating the error. If you are going to shoot a target tracking job, there are other stipulations that the move must obey, and these are covered in the Target Tracking section of this manual. Once the move has been verified as OK to calculate, the computer makes a path for each axis, and then checks each axis individually to ensure that it does not exceed the limits of its travel, does not exceed its maximum velocity or acceleration. Often while you are programming a move, you may need to process a move so that when you go into the graphs, the curves are displayed in range, or you want to find out if the rig will run the move without actually getting it into a "Ready to Shoot" or "Ready to Goto" state. This can be achieved with the "Check Move" button which is in the "Run Job" pulldown on the top menu bar. If the move is OK and will run the message "Move checked out OK" appears on the screen, otherwise the normal form of over limit or over speed warnings will appear.

Error Handling:

If any axes fail these checks, a message will be put on screen detailing each axis that fails stating what test was failed and at what frame count. If any axis exceeds its travel, you will have to fix that, but if the only problem is that one or more axes are running too fast, then you will be given the option of scaling the move up to more frames so that it can be run slower or slowing the camera down if you have a film camera.



The box that appears will have five buttons on it, a "Rescale" button, which will scale up the move for you, a "Cancel" button to ignore the box and allow you to modify the

move as you like a “Run It” button which will ignore the limits and run the move anyway, a "Step It" button which will allow you to shoot the move only as a number of stationary exposures, and a “Slower” button which will reduce the camera and move speed to a more achievable level.

The axis name appearing on the left of the display is set in a background that shows how serious the error is. Any axis that appears, has a problem, but a light green means nearly OK to run, and as the axis is less and less able to achieve the move, its background colour turns to red which indicates that the move cannot be achieve by that axis by a factor of 2 or more.

Some of these options will not be available if any axis exceeds it limits of travel as set up in the Axis Set-up Display for that axis. The “Run it” button is there as an out for experienced users who know their system, there is no guarantee that the system will perform and will not trip out and/or cause damage to itself. The “slower” option is not available on a VTR system.

Preroll and Postroll Limits Checking:

If a move requires a Preroll or a Postroll, the computer will check the movements of these to ensure that they remain within the confines of the limits of each axis. If any axis is deemed to exceed its travel during a postulated Preroll or Postroll, a message will appear on screen to that effect stating "Modify move or slow it down as Preroll/Postroll exceeds Max/Min limit of travel." In this case the name of the offending axis will be on the title of the message box. The handling for such a situation is to slow the move or modify it so that the axis does not Preroll or Postroll so violently. An alternative is to increase the Preroll or Postroll factor in the Axis Set-up for that axis.

None of the above limits checking relieves the operator of his responsibility for operating the rig in a manner that is safe. All high speed moves should be checked at slow speed and gradually speeded up rather than run at full speed immediately, and as stated above in the safety section of this manual; someone should be ready at all times that the system is under power to press a stop button or hit the red emergency stop. The Preroll and Postroll extends of the move can be viewed and checked using the “Goto → Preroll/Postroll Extent” on the Top Menu bar.

Shooting:

When the move starts, the axes move along their paths and the frame count changes through the move. To indicate the progress of the move, the Control Box Slider Bar moves showing the current frame count. If you are shooting the job forwards, it goes from left to right, and if you are shooting the job backwards, it goes for right to left, and the frame count you are actually at is shown just above the block.

Gotos:

A Goto will occur whenever the motors need to get from where they are to a specific position. The difference between a move and a Goto is simply that a Goto is a move from wherever the motors are to where they need to get to. It does not follow a path, it is a straight line move very like a simple 2 point move. Gotos move in straight lines as far as each axis is concerned, and takes no account of sets or other obstacles that might be in the way. A goto will occur whenever you run a move, and any axis is not in the correct start position for that move, whenever you ask the system to move to a certain point or frame in the move, and whenever the system moves to zero. The length of the goto is determined by the slowest axis, and all axes take the same time to move during a goto. The fastest an axis will move during a goto is at its maximum velocity reduced by the Goto Factor which is set in the Axis Setups. If axes are moving too fast or too slow, the usual handling is to adjust the Goto Factor for the relevant axis.

Whenever a Goto is required, a message will appear at the bottom of the screen next to the “HHB Speed” message which indicates the length of the Goto. If you expect a small short goto, and this box indicates a long one, check what the rig is going to do and make sure it is safe BEFORE pressing the “Goto” button. The position that each axis is going to and the time that each axis needs can be displayed using the Goto → GotoData button on the top menu bar. As mentioned above, all axes take the same time for a Goto, but this display will show which axis is taking the longest and thus setting the length of the Goto. Browsing Gotos is a safe option and a smart way to go in most cases as it allows you to move through the Goto under hand held box control and see before anything untoward happens.

More About Prerolls and Postrolls:

A preroll occurs when an axis needs to be moving at the start of a move. Most moves start with all axes at rest, but in some cases, the axis will need to be moving right at the start of the move. In this case, the axis will move away from its start position and will then run up to speed so that it reaches the required speed right at the beginning of the move. This occurs after the “Shoot” key has been pressed, and the system status will change to "Prerolling" while this is occurring. A Postroll occurs at the end of the move or when any move is stopped if an axis is moving. It is very similar to a pre-roll but is done to slow the axis down, and then return it to its correct position. Axes will pre-roll and post-roll differing amounts depending on their speed, their maximum acceleration and their pre-roll and post-roll factors. (See Axis Set-ups for data on how to adjust these). Please note that moves that start or stop very fast may produce tiny prerolls and postrolls. This is a by-product of the preroll and postroll system and is not an error. However it may produce a variable timing issue in the triggering of the move. The best handling it to add a single frame hold at the beginning or the end.

Preroll and Postroll paths:

The movement of the rig during a preroll and a postroll is the combination of the motions of all the axes. Depending on how long the axes take to pre and post roll, this can vary wildly from the actual move path. There is an option in the Job Type Display that allows you to either make the pre and post-rolls follow the move path as much as possible, or pre and post roll as quickly as possible. Depending on the shot and the constraints of the set, you may want to change these. See the section on Job Type Display for more data.

Part Runs:

A part run is a shortened version of a move. In a part run, you can state the frame you want the move to start at and the end frame for it to end at. What will happen is that the section of the move that you have specified will be executed exactly as if it were part of the whole move. If you have specified a start frame where the axis is moving, then it will pre-roll in order to get up to the required speed before the move itself starts. Likewise if you have specified an end frame where the axis is moving, it will post-roll at the end of the move in order to stop the axis and return it to the position of the end frame that you have stated. A part run can be from any frame in the move to any other frame in the move. It can also be from one frame to the same frame in which case only the goto will be executed, and no move itself will be shot. Part runs can also be backwards (e.g. frame 245 to frame 122). Please ensure that the move is safe and will not exceed the limits of travel of the rig, and that the motors will not go too fast.

The part run dialogue also has a pull down list of the last 10 part runs that were set to allow for quick setting of start and end frames on repeat actions.

Interrupting a move:

If the move is shooting and the mouse stop button is pressed, or the "STOP" button on the Control Box is pressed, the move will stop, the axes will post-roll, and then will return to the end of the last frame successfully completed. If this happens part way through a frame at single framing speeds, the frame will be completed, and then the rig will stop. Once the system has stopped, it (optionally – see Miscellaneous Set-ups) assumes that you want to continue to shoot the rest of the move, so it recalculates the move to start where it was stopped, and goes into the "Ready to Shoot" status. The 2 takes can then be matched up and treated as a complete shot. (You may have to cut the camera ramps off when editing film). This feature is not provided for on the Stop button on the Hand Held Box. If the stop button is pressed again while the system is stopping, it will stop all the axes with maximum acceleration - this is deemed to be an emergency of some kind.

Stepping:

Stepping is a means of shooting a move, section by section, so that animation can be done, or so that special effects can be created or so that a move which is too fast to occur at real time and be put together from a series of still exposures. Stepping can occur in many different forms and is a very versatile feature of this program. Stepping is done by pressing the "Fwd Stp" or "Bck Stp" buttons on the Control Box, and can only be done when the system is in the "Ready to Shoot" or "Ready to Step" mode. If you shoot with the camera at higher than its single framing speed, you will also expose ramp frames at the beginning and end of every take. Stepping should only be done at or below single framing speed - this speed depends on your camera, but for most, the make/break point is about 4 FPS.

Frames Per Take:

The first thing to note about stepping is that you can select how many frames of film are exposed with each step. This is often just 1, and that is the default value, but in some cases, single frame animation is very slow, and a good result can be achieved with shooting doubles or even triples. The number of Frames Per Take is set in the SFX (Special Effects) dialogue box. Press the "SFX" button, enter the number of frames you want each step to be in the "Frames Per Take" box, and "Apply".

Frames Per Step:

You can also vary the number of frames the system advances through the move with every step. This would usually be set to match the above figure, but not necessarily. The number of Frames Per Step is set in the SFX (Special Effects) dialogue box. Press the "SFX" button, enter the number of frames you want each step to advance in the "Frames Per Step" box, and "Apply".

Where does the exposure occur?:

Consider a simple move with 2 positions lasting one frame. When this is shot, the exposure will occur with a slight blur from when the camera shutter opens (about 1/4 into the move) until it closes (about 3/4 through the move). In effect you are recording the centre area between the first position and the second position. When you are shooting steps in Stop Motion, you can adjust where the exposure occurs from right at the beginning through the move up to right at the end. This is an extension of the "Take Before Step/Take After Step" feature which exists on the older Mark Roberts Computers. See the Special Effects chapter for more details.

Moving Step:

If you are shooting a move that the rig can do at real time but you want to animate something, you are often stuck with using stop motion photography which removes motion blur and can give a stark feel to the resultant film. The handling for this is to shoot the move in Moving Step. This effectively Part Runs every single frame of the move and allows you to animate in-between frames. The rig will expose each frame at the same speed as if it were shooting continuously, and moves shot using moving step can be matched to moves shot continuously.

Continuous Step:

If you are not actually animating between each frame, then having to press "Fwd Stp" for every frame can be very tedious. In order to get round this, there is a facility whereby the computer will take frames one after another automatically until you turn

this feature off. This is the continuous step facility and is accessed through the Side Menu Bar, there is a toggle button on this bar whose default label is "Single Step", when this is pressed, it changes to "Continuous Step", and then if you press "Fwd Step" or "Bck Step" when the system is ready to shoot, it will start taking steps and will continue until it reaches the end of the job. To turn off continuous stepping without stopping the move, simply toggle this button back to “Single Step”. Pressing the stop button will also set it back to “Single Step”, but may also stop the move.

Fwd and Back Step:

If you are running a move forwards, you will naturally want to step through the move forwards, the reverse is true for running a move backwards; you would naturally want to step backwards through the move. However both buttons are active, and you can change direction within the move as you are stepping; the camera will continue in the same direction for film, and this has no particular use, but the move will go in whichever direction you want. For a video system, the frame can be re-recorded, so a back step when you are running forwards is taken as an attempt to correct a mistake, and when followed by a forward step, will retake any frame(s) which were mis-exposed, and then you can carry on. (Single Frame VTR control is only available with PAL systems, not NTSC)

Shooting and Stepping:

Since you can step a move when it is ready to shoot, it is also true that you can shoot the move in this case. If you have an animation sequence to shoot, you can shoot any holds continuously with a part run, then go into stepping, and when the animation is completed, finish the shoot simply by pressing "Shoot" instead of one of the step keys. In fact, you can run the job forwards, letting it run till you reach the animation sequence, then press the mouse stop button, let the rig stop, go straight into single stepping without having to do anything else, and then straight back into continuous shooting when this is finished.

Browsing a Move

Browsing through a move forwards and backwards at variable speed can be very useful for checking the move out, looking for camera flares and a multitude of other reasons. This feature has been provided for with the "Browse" function. This function is accessible through the "Browse" button on the Control Box. When put into the browse mode, the rig will effectively execute a normal run of the move starting at the current frame. If a "goto" is required, you will be so prompted, but when it is in the right place, it will go straight into "Browsing" mode. When in this mode, the position of the rig along the move is adjusted through the hand held box, pressing the assigned forward key (or joystick) will accelerate the motion of the rig up to a percentage of the move speed and the move can be browsed backwards by using the reverse motion button (or joystick). (The assigned key is selected in the Miscellaneous Set-ups – “Browse Axis”) The rig can be run up to full speed by setting the Hand Held Box speed up to maximum or down to 4% of speed or even slower. Browsing to the end or beginning of the move will not drop you out of browse mode, you can simple press the other key and go the other direction. You get out of browse mode by pressing the stop key. As you browse, the current camera position (to the nearest frame) is displayed on the run control slider and on the Hand Held Box. Please note that if you are browsing a very fast track move, it is usually wise to do this at a reduced camera speed to reduce the likelihood of the track tripping out. Also note that you should not

browse at speed to the end or start of a move that has zero fairings as the rig will stop very suddenly and may trip out or cause damage.

Recording a Move:

Pre and Post Hold:

When you are shooting a move, it is often requested to have a hold at the end, or a hold at the beginning. In order to facilitate this, rather than have to note these separately, you can simply enter the length of the required prehold and the length of the required post hold. When the job is shot, the prehold is exposed first, then the move occurs, then the post hold occurs. These holds are only valid if the camera is in Record mode. If you run a move backwards, the post hold will be shot first, and then the pre hold. Access this feature in the SFX menu.

Film System:

Once the move is to your liking, you will probably want to record it. To take the camera out of dummy mode press the “Camera Dummy” button on the Control Box and it will change to "Camera Record". Before the camera will run you have to engage the camera which is done just like the other axes, simply press the "Frame" button at the top of the numerical display, the camera will engage and zero itself. At the beginning of the move, the camera will be started, and then the move will be shot with the camera running throughout and at the end of the move the camera will stop.

There is an additional means of running a move such as this. If your move has fairings on it, then you can start the camera rolling before the move itself is started. When you are at “Ready to Shoot” and you press the "TURNOVER" button, the camera will start running at the current move speed. This will carry on until the stop button is pressed, or the "SHOOT" button is pressed. If you press "SHOOT", then the move will be started in sync with the camera, and will continue as normal except at the end, the move will stop, and the camera will carry on running until the stop button is pressed.

This is particularly useful in live action situations where the director will call “camera”, and then call “action” a little later, and then after the move has stopped, he will call “cut”. In this way the three actions can be separated out to conform to the way shots are most often done. If you trigger the move in such a situation from an external trigger, the move will start when the camera reaches the next frame, NOT when the trigger is received (Though at live actions speeds, this should be within $1/10^{th}$ of a second).

This method will also work with an external camera. Once the camera is up to speed, you can press the shoot button. The system will them launch itself into sync with the camera and run until the end at which point, the move should stop, and the camera continue. You are strongly advised to test this before relying on it in a shoot condition.

If the camera is fully set up and ready to shoot, you can start the move with the camera in dummy and switch it into record during the move. When this happens, the camera will ramp up to speed and locking into phase with the motion of the axes. The reverse is also true, you can turn the camera off during the shoot. This may be done as often as you like during the actual move (though I can't imagine why you might want to!) as long as both the move and the camera are running forwards. (Do not try this is you are running a variable camera speed move of any kind)

Video System:

On a video system, simply change the button that says "VTR Off" to "VTR On", and any move shot thereafter will be recorded onto the VTR. When the move is run, you will be asked for a starting timecode for the recording. This is simply typed in, and then when the move is shot, the VTR will be controlled to record the move onto tape. The move once recorded can be reviewed using the "Review" button if your VTR supports this facility.

Alternatively to typing in the frame count, you can use the mouse “Store Button” to store the current timecode into the starting timecode entry box. The Timecode Entry box also has buttons to allow you to select the new start point as the current timecode on the device, the last In Point or the last Out point.

Independent Camera Control:

There are 2 ways in which the camera can be controlled independent of the move. One is using the button on the Control Box labelled "Turnover" just above the “Take” button. When this button is pressed, the camera, if engaged and in record mode, will start shooting film at the currently selected move speed. It will keep on going until a stop key is pressed or the "Turnover" button is pressed again. The camera will run in the currently selected direction when this is done. The other means of control is to use the "Shoot Slate" button at the bottom of the Side Menu Bar. When pressed, this causes the camera to take as many frames as are set up in the Camera Axis Setup display. The slate will be shot at the speed set in the camera Set-up unless it is set to 0 in which case it will shoot at the currently selected move speed. Neither of these functions are available on video.

Live Action Camera:

Please note that when the camera is running, the hand held box is active. If you are trying to shoot a lock off, then do not touch the hand held box or else turn it off. The up side of this is that you can move the camera around while it is filming using the hand held box or Grip-Sticks and so use it like a normal camera crane. Moves performed this way will not be recorded – see the chapter on Mimic for this feature.

CHAPTER 9 - JOB STORAGE

Introduction:

When a job has been shot, it is quite often useful to be able to store that data onto a disk for later retrieval and re-shoot. In order to do this, a job storage facility has been incorporated into the program. When a job is stored, all the move data along with the vast majority of the system configuration at the time is stored so that when it is read back in, not only is the move retrieved, but also the accompanying Set-ups that will allow it to be repeated exactly. It is also possible to only read in the move data if so desired, this is quicker and avoids resetting any other data that you want to remain the same: - this feature is called "Simple Read".

Automatic Store:

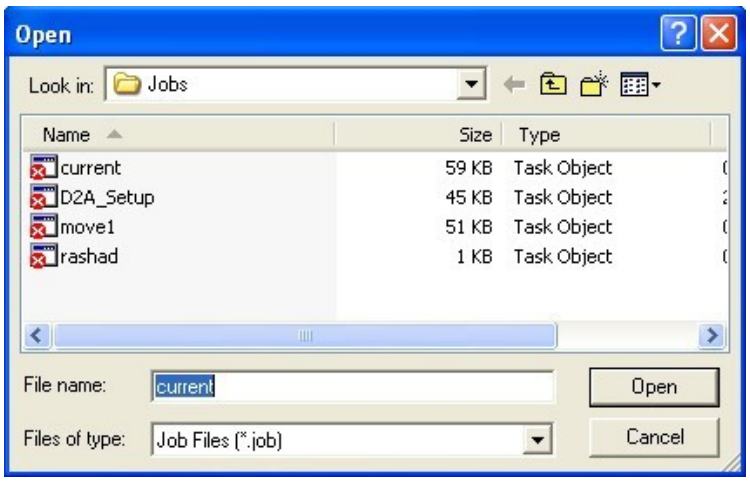
Whenever a job is calculated, it is automatically stored to disk and a short beep is emitted by the computer to indicate that this has happened. The job will have been stored under the name of "current.job" and can be easily read in. The advantage of this is that if there is a power failure or other unexpected interruption, the data in the computer will not have been lost and the move can easily be recovered. This is called the “Current Job”. This feature can be disabled for speed if so desired in the Miscellaneous Set-ups display. (It is also accessible through the Numeric Display context menu which is available if you right click anywhere on the main numeric screen where there is not a line or you can shift click on any position line.

Crash Store:

If there is a system error with the axis boards and for some reason, the communications between the axis boards fail, it is possible that the program will continue operating. In this case, you will be presented with a dialogue box giving you the option of saving the job, and exiting the program. Since the only solution at this time (if the fault does not self correct) is to re-load, you can store the existing job to disk for later recovery. This job is called the “Crashed Job”. To recover it, read it in like any other saved job.

Job Storage Dialogue Box:

The Job storage dialogue box appears whenever you attempt to read, or write a job. The box is basically the same for both, one being an “Open” File Dialogue box, the other being a “Save” File Dialog box. These boxes will automatically open in the “File Details” mode to make it easier to sort and select jobs.



Since this is a standard Windows Dialogue Box, you can also delete jobs and create new directories in the usual manner, however it is a single file selection box and only one file can be selected, moved or deleted at a time. When you save a job to disk, if you have selected "Auto Inc File Names" in the miscellaneous setups, the computer will automatically add a number to the end of the last file name, or increase the value if there is already a number there. This can make life much easier when storing multiple versions of a job, for example when you are shooting multiple takes of a move, and there is a slight variation between each.

Single Click Job Storage:

It is a smart idea to save versions of the job as you go so that you can easily undo any changes that are not desired. It is also vital to save any mimic moves as they are learnt so that you can replay any good takes. To avoid having to pull up the job store dialogue box every time, you can store/retrieve the job with a simple click on the box above the "Frame" and "Posn" buttons which normally displays the current job name. Left clicking on a valid job name will prompt you if you want to read that job in. Middle clicking will prompt if you want to overwrite the job of that name and right clicking will auto-increment the job name and save it or prompt you if a job already exists of that name.

Job Storage Progress Bar:

Writing a large job to disk can sometime take a while, especially if you have mimic data recorded with the move. If a job is of 400 waypoints or more, a box may appear when you read or write a job that lets you know that job storage is progressing. This box has a small bar that fills up to let you know it is progressing, and a cancel button if you change your mind and want to stop writing or reading the job. If this button is pressed, the current job is cleared out if you were reading a job, and if you were writing a job, then that name is deleted from the system. You are advised not to use this button unless you are sure you want to.

Exporting Jobs:

Since the jobs are stored as simple files, it is very easy to copy jobs out of your computer and onto a flash drive or external media. In this way old jobs can be removed from the computer and stored elsewhere if needed, or even sent to MRMC for investigation if there is any problem with a move. In fact the easiest way for us to check out suspected faults is to send us the job on a disk or via email. In order to do this it is necessary to have some familiarity with the operating system being used on your computer. Do not attempt to edit the job file as it is not in any recognisable format.

File Backup:

As you save jobs, they can also be written to a secondary location without any additional input from the user. In the unlikely event of a hard disk crash, the job can then be loaded onto another computer and you can be up and running again in a few minutes. This functionality is accessed through:
'File → File Backup and File → Backup Location' menus on the top menu bar. This is described further in the Main Display Chapter (q.v.)

Errors:

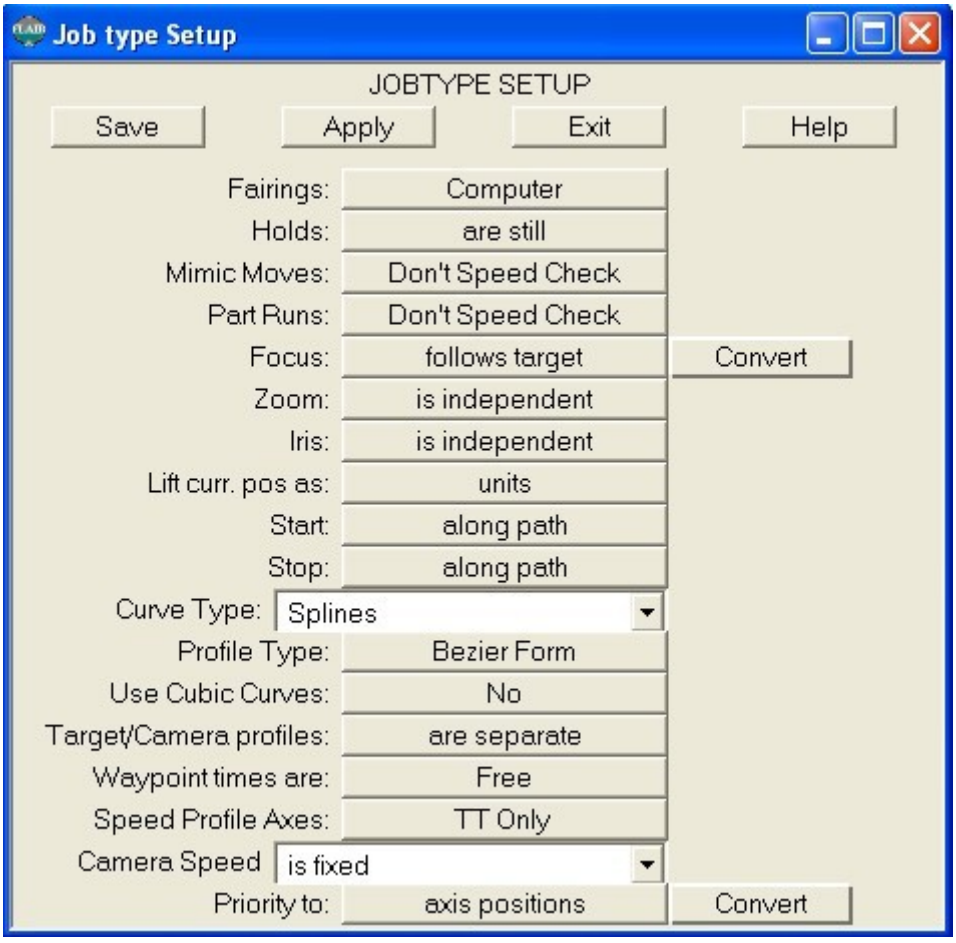
There are quite a few possible errors that can occur during job reading or writing, most of which are self-explanatory and usually boil down to an error in naming a file or some sort of typographical error. There are some system errors that can occur, and if these do occur, note them down and inform Mark Roberts Motion Control soonest for advice. If the reading or writing is aborted, you can always retry, making sure that the computer is not in a run state such as "Ready to Goto" etc. When you read or write jobs the system should be in the normal idle state when it will display the normal rest state message such as “Flair Motion Control".

CHAPTER 10 - JOB TYPE

The Job Type Display is composed of various switches which affect the way in which the system operates, and how jobs are run. Each switch has a name on the left, and on the right is a toggle button or a pull down combination box that allows you to change the state of that switch. Clicking with the left hand mouse button on the toggle button will advance the setting to the next state. Clicking with the mouse stop button (middle button) will set the state back to the default state.

Save, Apply & Cancel:

Like many of the dialogue boxes, changes you make are not automatically accepted. You can check that the changes are to your liking before you Apply, or you can throw away the changes just by pressing "Cancel". If you want to set default values for the toggles so that every time you turn the system on they start in a certain state, simply select the desired states and use the "Save" button to store these to disk. This will ALSO save the state of the Target Tracking toggle which is on the Control Side Menu Bar.



Fairings: User / Computer

When a 2 point move is being run, the user can allow the computer to generate its own fairing for the move, or the user can define his own. See Chapter 7 "Move Entry" for further data about fairings. The computer-generated fairing causes the motor to speed

up for half the move, and slow down for the second half. Computer-generated fairings are the equivalent of setting the user fairings to 50%.

Holds - are still / can move

When 2 identical positions are followed or preceded by a different one, it is possible to draw a curved path through all three points, and this may be what is desired. More usually, 2 identical positions indicate a hold, and this switch will cause a hold to occur between adjacent identical positions as opposed to making a curve between them.

Mimic Moves Speed Check

Specifies whether to apply speed check while the rig is being moved through a mimic controller.

Part Runs Speed Check

Specifies whether to apply speed check while a Part Run is being executed.

Focus - is independent / follows object / follows target

The focus axis can be driven as a normal axis running between entered points, and when this switch is in the "is independent" state, that is what happens. There are 2 other states in which the focus is driven to hold focus on a target which moves. In this way, target distances can be measured, and the focus will automatically maintain a sharp image of the target (or a soft one if you want!) These 2 modes are "follows object" and "follows target". When in "follow object", the distances entered in the focus column are taken as distances to an object, a curve is fitted through these, and then as the move is run, the focus is moved to maintain focus on the object as it moves. "follow target" is only valid when you are in Target Tracking, and the focus is driven to maintain focus on the Target as worked out from the target tracking maths. "Follows Object" can be used in target tracking, and would be particularly applicable if you wanted to target track one particular object, but focus on something else. When you are in "Follows Target", the focus column holds a copy of the Target column, and this will be displayed in brown. When you are in "Follows Object", the distances in the focus column are focus distances and are displayed in yellow. The “Convert” button to the right of this entry will prompt you if you want to copy distances from the entered Target Positions into the Follow Focus distances which could be a good starting point if you are switching from “Follows Target” to “Follows Object”. These states may also be selected from the Axis Context Menu which is brought up by right clicking on the focus axis name.

Zoom - is independent / is linearised / in focal length / in view angle

Tracking in on an object and zooming in both produce a change in the field size at the object you are tracking in on. However, while a constant speed track in will produce a constant change of field size, this is not true of most zoom lenses. If you want to create a smooth zoom that looks like a track (ignoring perspective changes), you have to linearise the motion of the zoom. The actual zoom linearisation is done through the lens Set-up which is described in Chapter 4 of this manual, however once this Set-up is done, you can use this data in several ways. If you are in "Zoom is Linearised", then the computer will drive the zoom axis to try to achieve a consistent change in field size. You can also do this and display the data as the focal length of the lens or optionally as the view angle. Please note that the view angle may not be what you would normally consider to be the view angle as that depends on many factors such as

the format and whether you consider view angle as horizontal, vertical or diagonal. The number displayed here is merely meant to be indicative of size. If you require more detail please contact MRMC. In the Focal Length and View Angle modes, you can directly enter focal lengths or view angles as numbers, and the reported current position of the zoom axis will reflect the current focal length in millimetres or the current view angle in degrees. When you are in "Focal Length" then the positions column for the zoom axis is shown in blue, if you are in "View Angle" then it is shown in green. These states may also be selected from the Axis Context Menu which is brought up by right clicking on the zoom axis name.

Iris - is independent / in stops

When the system has an iris axis that is fully configured to drive the iris ring, the iris axis can be programmed in stops rather than in axis positions. This means that you can program a stop change by typing in the stop numbers (e.g. 5.6 to 11). This can be useful for changing light conditions and also is used when you are using the system's Variable Camera Speed option. When the iris is in independent mode, then it acts just like a normal axis. When in the "stops" mode the current position of the iris axis will display the current stop on the lens and will be in red. These states may also be selected from the Axis Context Menu which is brought up by right clicking on the iris axis name.

Lift Current Position as units/degrees

Toggles the display for the lift between Degrees and Units; This may also be selected from the Axis Context Menu which is brought up by right clicking on the lift axis name.

FDX Shutter - leads / trails

On a camera that has a shutter, there are 2 half moon shutter blades than move relative to each other in order to open and close the shutter, one of these is in a fixed relation to the gate, and the other moves. If the moving blade leads the fixed blade (when running forwards), then this toggle should be in the "FDX Shutter leads" state, if the moving blade follows the fixed blade, it should be in the "FDX Shutter trails" state.

Start - quickly / path run up / quick run up / along path

This toggle applies to Preroll as covered in Chapter 8 "Running a Move". When the system has to Preroll in order to get up to a specific velocity to start a move or section of a move, each axis works out how long it needs for this Preroll, and the actual Preroll takes as long as the longest axis with each axis starting to move at their own time, this can result in the rig moving in an unusual way before the move actually starts. In extreme cases, this can lead to the position of the rig leaving the desired move path sufficiently to be potentially hazardous in a tight set. In this case, when "Start along path" is selected, all axes Preroll together and the preroll path will approximate the move path much more closely. It is highly advised that you experiment with these switches and their effects BEFORE you use them on set. Whilst "Start along path" might be gentler and closer to the path, it will also move further.
The “Run Up” modes also have the “Quick” and “Along Path” options, but these modes will drive the rig to a calculated pre-roll position before it goes into “Ready To Shoot”. This generally requires a little more distance for the run up, but is more comprehensible for most people as they do not understand why it starts going in the wrong direction in the normal preroll mode. Also note that the “Ready to Shoot”

position is NOT the same as the start frame of the move when this form is being used and the move starts at speed.

Stop - quickly / path run past / quick run past / along path

As above, but this relates to Postrolls. When a move is stopped either by the user or when it comes to the end of a move, the rig if still moving will go into a Postroll. As with Prerolls, the action will last as long as the greatest time needed by an axis to Postroll, and the other axes will stop in their own time during the Postroll when this toggle is in the "Stop quickly" state. When in "Stop along path" all axes will take the same time to slow down and the resultant movement will more closely follow the move path. If however while this is happening the user presses a stop button again, all the axes will immediately stop as quickly as they can at full deceleration. The “Run Past” modes also have the “Quick” and “Along Path” options, but these modes will run the rig to a calculated post-roll position at the end of the move. This generally requires a little more distance for the slow down, but is more comprehensible for most people as they do not understand why it reverses direction in the normal postroll mode. Also note that the end position is NOT the same as the end frame of the move when this form is being used and the move ends at speed. This setting also affects how the rig stops when you use the middle mouse button to stop it while it is moving on a Goto or being jogged.

Curve Type: Splines / Beziers / Linears / Cubics / Quadratics / Quintics / Quik Cubics / Bounces / FSplines / Quik Quintics / Ramps

There are numerous ways of fitting a curve to a series of points. In general you should only use Splines, Beziers or Quintics. The other methods are pretty developmental and may cause unexpected or undesirable results:

When a curve is generated by the software it normally uses a curve form called a spline. (A spline originally meant a flexible strip of wood that you could bend to form a smooth curve) This form is used as it has a smooth shape and can produce movements that have a lessened incidence of causing the rig or table to shake due to rapid changes in acceleration.
Curve reversal detection and handling is currently only valid in Splines.

You can alternatively use Bezier Curves when in target tracking, these curves have the advantage that you can change the shape of the curve without changing the actual plotted points because each Bezier point (except the first and last) has 2 control points that affect the way the curve arrives at and leaves each waypoint.

Linears make straight lines between each point, but this will not work well as it makes for huge accelerations at the points.

Cubics work quite well except they tend to use higher accelerations at the waypoints. This may be desirable. If you find that splines have too “floaty” a feel, then cubics may work for you.

Quadratics do not work and will cause the system to crash.

Quintics are a fair approximation to the splines, but have a quicker calculation time with multi point moves, and in fact your software will switch you into Quintics if you enter more than about 40 points.

Qwik Cubics are experimental and work much like Quintics with the exception that you are provided with a toggle control in the graphics setup with which you can change the slope of the graph at the waypoints.

Bounces will produce almost linear moves, but will use the last few frames to abruptly change direction – set the number of frames through the Fairings Set-up.

FSplines will force the system to use splines even though you have more than 40 or so points. Be warned that as you add points, the calculation time increases exponentially and you will run into the communication to the rootbox timing out. If this occurs, you can increase the timeout – see the "Advanced Configuration" chapter.

Qwik Quintics: Experimental do not use

Ramps: Experimental do not use.

Profile Type: Bezier Form / Cubic Form / Fairings Form

Speed profiling is described more fully in the Target Tracking section of this manual, however the basic principle is that you can modify the speed along a curve without changing the actual path of the curve. This toggle allows you to select 3 different ways of doing this and these are described in the chapter on Target Tracking.

Use Cubic Curve: No/Roll/Roll&Master

Cubic curves are easily understood and communicated to 3D software. If you are importing or exporting curve forms with 3D packages, you should set this flag depending on which axes you are importing/exporting. Please note that this is only applicable to "curve" data, not "raw" data (a point per frame), and that cubic curves tend to accelerate/decelerate more abruptly than the normal system curves. The Master axes can also be imported and optionally may also follow cubic curves.

Target & Camera Profiles - are separate / are locked

When Bezier curves are used as per above, then the way in which the path is traversed is totally independent of the times entered on the waypoints save for the first and last times. This means that you can control the speed that the camera or the target moves along its plotted path. This feature can be used to create effects that normal splines will not allow you to. Since the camera and the target are 2 totally separate paths, you can control them independently, or you can have the speed profile of the target locked to that of the camera, so that as the camera speeds up along the path so does the target.

This feature is also provided for on the Speed Profiling Display and can be used after the move has already been plotted. See the Target Tracking chapter under Speed Profiling for more data.

Waypoint times are - Free / Locked

When you are running Target Tracking move in Beziers, the timings of the waypoints are essentially ignored for the target and camera move. If you explicitly want the

waypoints to be passed through at the times you have stated, then this flag should be set to "Locked" before you start programming the move. Should you have already programmed the move, then the waypoint times can be locked afterwards. Consult the chapter on Target Tracking for more data.

Speed Profile Axes: TT Only/ TT&Mstr /All.

This facility allows you some more flexibility in speed profiling. Normally when you speed profile a move, the Cartesian data is speed profiled, but not the master axes. You might find that this could lead to some problems with the master axes lagging behind or too far ahead of the rig so that the move will not run. Profiling the Master axes means that the time factor that is being passed to them is the same as the one being used to profile the carts. You can also use this profiling to vary the speed for the other independent axes such as model movers etc. This mode will only really work when you are using normal curves and not Bezier curves.

Camera Speed: is fixed / varies / ... / ...

Turns on and off the variable camera speed functions and sets the exposure compensation option. You can also select to have the move being at fixed speed, but the camera speed to vary. You of course could not shoot repeatable passes at different speeds, but this may be a desirable option.
See chapter on Variable Camera Speed for a full description of this feature.

Priority to: axis positions / Cartesians

A Target Tracking move can be represented as axis positions or as Camera and Target Cartesian positions. When you start editing one of these, the 2 representations of the move do not match exactly, and this toggle allows you to select which one has priority. When you are in "Priority to Axis Positions" the Cartesian positions are modified whenever the axis positions are changed. When you are in "Priority to Cartesians" the move is based upon the Cartesian positions which are set when the flag is switched, and can only be edited directly, not through adjusting the axis positions. This is quite a complex topic, see the Chapter on Target Tracking for more details. To the right of this button is a “Convert” button which allows you to convert a Cartesian Move back into an axis move. See the Section on Reverse Kinematics in the Target Tracking chapter for more details.

Note:

If there are any other buttons in your job type box that are not listed here, then you have had an update or upgrade in the software beyond this revision of the manual, in that case, check in the back of the manual for any addenda or contact Mark Roberts Motion Control for additional data.

CHAPTER 11 - TARGET TRACKING

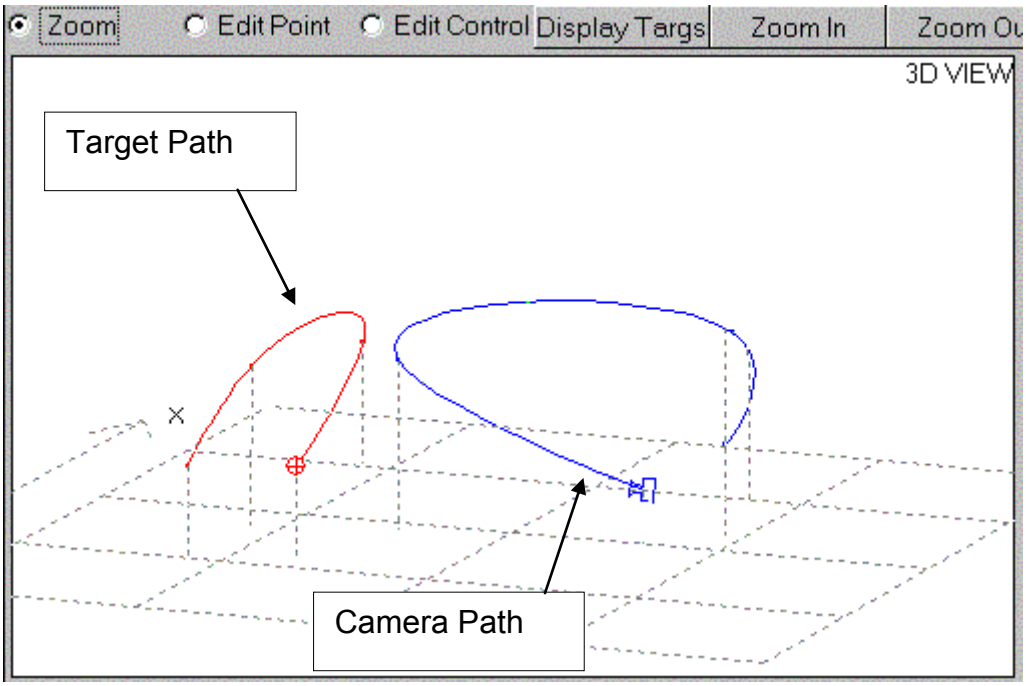
Principle of Operation:

Hold your fist directly in front of your face, and move it away from you in a straight line. As you do this, you can see that your wrist, elbow and shoulder all operate independently to create the desired movement of your hand. You know the path you want your hand to follow, and the different muscles (motors) and joints (axes) are driven to achieve that path. This is the simplicity of Target Tracking, rather than trying to control individual axes to generate the path you want, you define the path you want, and the axes move to achieve it.

Viewpoint/Camera Path and Target Path:

When in target tracking, the computer knows the shape and arrangement of the axes that drive the rig and it can work out exactly where the camera is and from the distance to the target, it can also work out exactly where the target is in 3 dimensional space. This data is calculated for each waypoint entered, and a 3 dimensional curve is fitted to the camera positions and to the target positions. These curves are referred to as the Target Path and the Camera Path. The exact point that is considered as the camera point or view point is defined relative to the Front Nodal Plane of the lens. For a more detailed description refer to the Lens Set-ups section of this manual.

When the move is actually executed, the computer moves the axes so that the camera follows its plotted path and always looks at the target as it moves along its path. The advantage of this is that you can make the camera lock onto a target and hold it in frame throughout the move while the camera moves along the path you want. Since the target is also defined as a path, you can lock onto a stationary target or a moving target just as easily - hence the name "Target Tracking".



Target Tracking Move Entry:

Entering a move is very similar to the normal move entry, plot the waypoints you want the move to pass through, and at each waypoint, measure the distance to the target and enter this into the target box for that waypoint. If you have the focus axis in follow target mode, when you store positions, the computer will actually suggest a target distance based on the current position of the focus axis, but it is sometimes more accurate to measure the distance. Once all points and distances are entered, the move can be run just like any other move. Fairings and exponentials can be applied as in simple moves, except that the fairings and exponentials apply to the Camera and Target paths, and not to the axes themselves.

Measuring the Target Distance:

Target distances are measured in the units your system has been set up for; this can be inches, feet, centimetres or metres. The measurement is taken from your selected measuring point to the target and is entered into the relevant target box for that waypoint. When you are a long way from the target, it is more accurate to measure the distance. When you get very close (a few focal lengths away), it can be easier to focus accurately on the target, and get the computer to work out how far away it is. The measure point is usually the film plane, but this can be in another location if that is easier for you; see the Lens Set-ups for more information on this.

Target Tracking and Independent axes:

A Target Tracking axis is defined as an axis whose position affects either the camera position or the target position or both when in target tracking; an independent axis affects neither. In a target tracking move, independent axes can be run as normal axes, and can have fairings or exponentials of their own applied to them as you wish. A likely application of this is having a motor or motors moving a model mover which is independent from the move, and also the focus axis doesn't actually change the position of the target or viewpoint significantly, and can be run as an independent axis if so desired. In these cases, it is possible that you would want to define a waypoint that was for the model mover only, and did not affect the Target Tracking move or vice versa. To handle this, you can have target tracking waypoints and non target tracking waypoints. A target tracking waypoint has a target distance entered and a position entered for EVERY target tracking axis, it may or may not also have positions entered for independent axes. A non target tracking waypoint has no target distance entered (the field is blank) and must have NO positions entered for any target tracking axes, it also may or may not have position entered for independent or master axes.

Target Tracking Axes and Master Axes:

There is also a subtle distinction between Master Axes and Target Tracking Axes. If your rig has more than 5 major axes (usually Track, Rotate, Lift, Pan and Tilt), then more than one axis can be used to produce the same result, (e.g. an extending arm can move the camera forwards, just like the track in some cases). When this occurs, one or more axes will be termed "Master Axes" and will have been set up by MRMC at installation time. A Master Axes behaves just like an independent axis above, it can have fairings, and can have points on non target tracking waypoints. How this works and how it can be used to assist in move planning will only really be accomplished through experience and familiarity with Target Tracking and its operation. If you have specific questions, please call the Software Department of MRMC.

Up Point:

Most of the time when you are running a move, you want the roll of the camera to keep the horizon level. Or perhaps add a little "dutch" in as the camera moves around. This is normally achieved relatively easily with the software through the various roll control modes. You can however get into a problem where the camera looks straight up or straight down. In this case, the horizon is lost and the roll axis will often flip around and trip out. You can manually program the roll in this case, but that is pretty laborious. Another option is to use the "Roll Up" move of roll control.

This mode is virtually identical to the 3rd node in a 3 Node camera in Maya™, and is used to set a point which should always be "up" in frame, so if the point is below the camera, then the camera has to roll upside down to make that "up". This mode of operation is particularly useful for situations where the floor is not parallel to the horizon, which can occur with models that are not mounted flat and other effects work. You can also use the scaling feature to "tip" a move of off level, and when in the "Roll Up" mode, this will not affect the shape/look of the move.

An Up Point is created whenever you store a target tracking waypoint, and if you are in "Roll Up" mode, then these points are splined in exactly the same way as the other target tracking paths are splined.

Target Tracking Pan, Tilt & Roll.

Standard Target tracking with the Flair software has always defined positions for the camera and also for the target, and the splining of these points has produced a camera path and a target path. A new version of target tracking has been added which treats the camera position in exactly the same way, but instead of splining the target position, the computer splines the camera orientation in terms of the direction it is looking and the roll of the camera. The 2 systems are both quite valid and which one you use will depend on the effect you want to create. If you are looking at a stationery target as you move the camera around, you will almost definitely want to use standard Target Tracking as you would if you had to pull focus on something that was intimately connected with the camera path and target path.

As an example of the 2 systems, imagine a move in Target Tracking that was simply a 2 point pan from -90 to +90 with a target at 100.00 units away. A standard Target Tracking move would plot an almost stationery camera with a target path that goes from 100 units away, straight through the camera and out to 100 units the other side. This move will not run as the target cannot pass through the camera. The positions are valid and what the computer is trying to do is expected but may not be the result you wanted. If you enter this in PTR Target Tracking, then the camera motion is exactly the same, but the orientation of the camera in space is driven by a spline from -90 to +90 degrees and so the camera will pan from +90 to -90 through the move which would be much more what the user was expecting.

In many cases, you can get the same results from standard Target Tracking as you can with PTR Target Tracking. The cases where you might be swayed into using the PTR form would be when you are more concerned about the orientation of the camera in space than where exactly it is looking and also where the target would be getting very close to the camera as this can cause some unexpected results in standard Target

Tracking. The best thing is to try these various methods out and find out for yourself what the advantages or each are.

Move entry is very similar to normal Target Tracking moves, but the Target column is irrelevant and a waypoint is determined to be a target tracking waypoint if there is a position for any target tracking axis, in which case there must be a position for every target tracking axis. Normal target tracking is the default mode for the Flair system and if you have any problems with PTR target tracking, try the normal mode as well.

As of Version 5.1, you cannot have the Pan cross the +180 or -180 boundary. That is you cannot cross through looking directly backwards with the camera. This will be fixed in a later version.

Easy TT:

Easy Target Tracking is a simplified form of target tracking in which the major axes are all splined just like a normal non target tracking move, but the pan and tilt axes are run to follow the target path. This avoids some of the complexities that you can encounter doing Target Tracking, but it also negates some of the powerful features only available with full use of Target Tracking. For example, normal Target Tracking does not like the rotate axis to change from in front to behind the rig or vice versa, and will usually cause problem with speed limitations. With Easy Target Tracking, the rotate axis is simply splined and will do whatever the move required of it without running into this problem. However, you cannot scale this move or use other advanced Target Tracking functions.

Limitations:

There are some limitation to what the target tracking can do, and when encountered these can cause unexpected motions to occur.

Tilt 90:

Unless you have specifically been provided with software to handle it, the tilt may not go to or through a position where the camera is looking along the axis of pan. If you can move the pan and the image rolls rather than pans, then you are in this situation. This is referred to as Tilt 90 and is a mathematical problem as the exact position of the pan is indeterminate when this occurs. The indicators of this are extremely large frame counts being requested for a move on the pan and/or tilt axes and if you go into the graphics display, you will see the pan or tilt axis graph going right off the screen. The handling is simply to plot the move in a way that does not encounter this situation. (see note below).

Rotate 90:

If you have a fixed length arm there is another mathematical problem that occurs when the arm is at 90 degrees to the track. In this case there is no way for the rig to control the position of the camera in a side to side manner, and in order to overcome this, the track is moved rapidly backwards and forwards over this period. This will almost undoubtedly produce an unacceptable move and can be handled by modifying the waypoints to avoid going to or through 90 degrees. This applies to +90 and well as -90. This problem can be worked around if you have an extending arm. In this case, the axis that drives the arm must be a target tracking axis - this is usually possibly

only with the Mark Roberts Motion Control Milo or Cyclops; and then the Track would have to be a master axis. Check the state of the "Master Track/Extend" value in the kinematics Set-up.

Note: Even if you have plotted points that are not going to these points or through them, they can be encountered when the rig executes the move. If this occurs, just move far enough away from this zone to handle the problem, this would be typically about 5 or 10 degrees away from the 90 degree position.

Please also note that if your camera path for any reason goes outside of the allowed side to side range of the rig, the rotate will simply go to 0, and there may be discontinuities in the Rotate's motion. If you see the rotate either staying at 0 the whole time or dropping to 0, this usually means that you have encountered the problem above.

Tilt 90 Handlings:

The most usual way to get around a tilt 90 problem is to reposition the move or the subject such that you are not running the tilt across -90 degrees. You can run the tilt from positive down to -85 , or from negative up to -95, it is crossing the -90 zone that causes problems. The same problem actually occurs at +90, but that is not a position that most cameras can go to. The handling for this condition with a rig that has an Angle axis can be to re-position that Angle axis so that the -90 position is not used during the move. For example, a lift from the floor to maximum height with a Milo rig will cause you to go through tilt 90 if you are looking straight ahead. However, offset the move to the side by a couple of feet, and as the arm and Angle lift up to level, the pan axis is doing the tilt motion, and the tilt axis itself hardly moves. Sometime with an Angle axis, you will find that the rig has a move programmed that goes through the -90 zone, but that when you shoot the move, the rig achieves the move without going through -90 and in fact goes to the physical location you specified, but the pan and tilt read different numbers (-180 different). This is not a problem unless you run the move backwards. In this case, the pan and tilt will flip around and come to the same orientation, but the other way round. If this happens, run the rig forwards and store the end position again when the rig reaches it. (See also the section on reverse kinematics further on in this section).

Tilt 90 Software handlings:

There is some software implemented which does something towards handling tilt 90 conditions. It does not work properly all the time, so I cannot recommend it, but it may get you out or a tricky situation. If you have set the Tilt90 Zone in the Kinematics Set-up to somewhere between 10 and 20 degrees, and have set the Tilt90 handling in the Miscellaneous Set-up to "Handle", then some form of handling for the Tilt90 region should be implemented. Positive feedback on the workability of this software would be greatly appreciated.

Cartesians: Numeric and Graphical:

When originally written, Target Tracking only applied to the Camera and Target Position. Subsequent development has added other notional axes to this list and the final list as of Version 5.1 is :X Camera, Y Camera, Z Camera, X Target, Y Target, Z Target, Pan, Tilt, Roll, X Up, Y Up, Z Up, Lens, Interocular and Convergence. These axes are virtual or notional more often than not as there is no simple conversion from motor position to virtual position. "Cartesian" was a good name for these axes when

the software was first developed, but this has become something of a misnomer, and they should more correctly be called “Virtual” or “Notional”. The first 12 relate directly to the camera position and orientation, the last 3 are somewhat different and refer to the Lens i.e. focal length of view angle and then the Stereoscopic settings for shooting 3D. The Interocular and Convergence have only been added recently and are not currently fully implemented, but should be by version 5.15.

Numeric Cartesians:

Target Tracking positional information is stored in the system in terms of Camera Cartesian positions and Target Cartesian positions. Cartesian; when referring to a point in 3D space means that its exact location is represented by three measurements along the 3 dimensions. Along the X, Y and Z axes or in laymen's terms, height from the floor, distance forwards, and distance to the side. This sort of information may not be directly useful to the user, but it can be displayed and edited in the Numeric Carts Display. When this display is selected, a screen very similar to the normal Numeric display is shown except that the axes names are not "Track", "Lift" etc. but "X Cam", "Y Cam", "Z Cam" and "X Targ", "Y Targ" and "Z Targ", The PAN, TILT and ROLL Also X Up, Y Up and Z Up, Lens, Interocular (I/O) and Convergence (there may be other axes to the right, but ignore them). The positions listed below are the plotted XYZ positions of the camera and target for your move. These positions can be manually edited, stored using the mouse button and generally modified in much the same way as you can with the numeric axis positions. The Numeric Cartesians that are valid in standard Target Tracking are X, Y & Z Camera and X, Y & Z Target. In PTR Target Tracking, they are X, Y & Z Camera and PAN and TILT of Camera. Please note this is not necessarily the same as the Pan and Tilt axes and it is important to know and understand the difference. In Roll Up mode, then X Up, Y Up and Z Up are used

Warnings

This display was originally intended to display information to the user should he so desire to see it. You may edit the data, but please be aware that you will only be modifying the move when you change these positions if you have set the “Priority to” flag in the Job Type display to “Cartesians”. Once this is set, then the Target Tracking axes positions become irrelevant except that the entered position is used as a starting point to find the position required by the Cartesian data.

Advantages

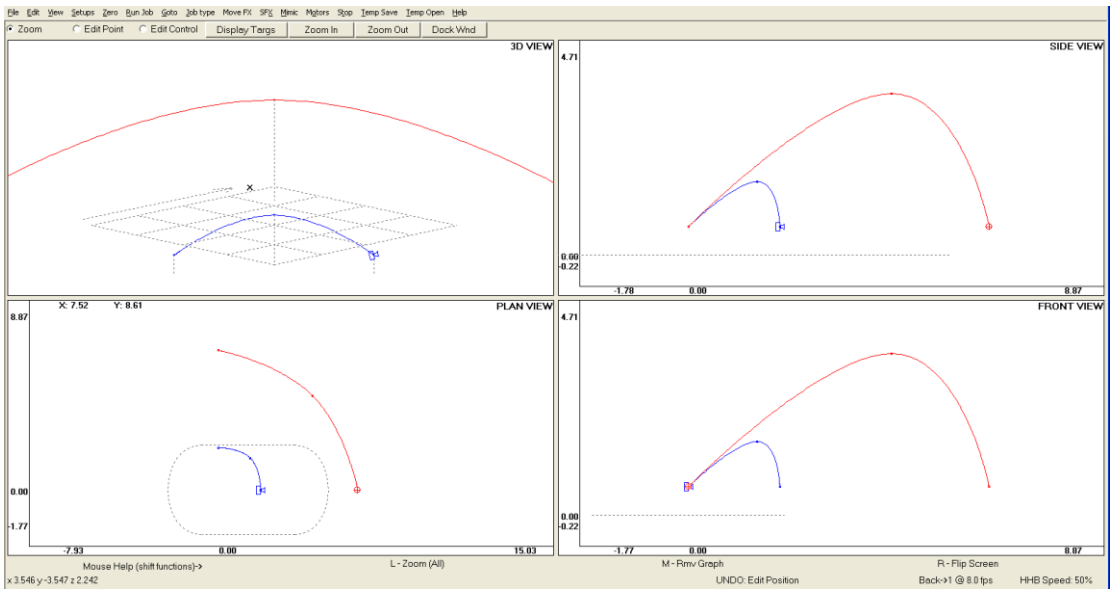
You can offset a move by a distance in any axis by simply typing the offset you want into the top of the column that you want to offset and entering the "+" key or "-" key in exactly the same way as you can with axis positions, but in this case, it will make a more logical change. You could lift the entire move up 1.0 metre by adding 1.0 to the Z Cam and 1.0 to the Z Targ Columns (And Z Up if in Roll Up mode).

Note:

The Target Column and other axes columns that are visible in this display will allow you to edit the target distances and the positions for those axes. It is not recommended that you do this. The axis enable/disable feature is also not available in this display.

3-D Graphs:

Three dimensional graphs are provided so that the user can inspect and modify the graphs to achieve the exact move wanted. There are 4 graphs, the first is an actual 3D representation of the move, and the others are 2D views of the move path from above (Plan View) from the side (Side View) and from the front (Front View). Each of these shows 2 of the dimensions against each other i.e. X against Y, Y against Z and X against Z. On each graph 2 paths are shown, the red path is the target path and the blue path is the camera path. There is a small graphic representation of the camera on the camera path and the target on the target path located at the current position in the move. If you stop the move half way through and look at these displays, the camera will be in the middle of the move, looking at the target which will be at its respective position on its path. In the 3D representation, there is a grey grid that indicates the floor level and also an arrow marked with an X that indicates positive X motion. In the 2D displays of the 3D data, there may be grey lines which are an approximate representation of the range of motion of the rig. This is for assistance when importing moves into the system to make sure that they are within the bounds of motion of the rig. In PTR Target Tracking, there will only be a camera path.



3D Graph Control Buttons

As with the axis Graphic Display, the exact operation of each mouse button differs depending on which mode you are in.

Zoom:

Zoom: This button operates in the same way as the zoom feature on the 2D graphs. When the graph display is in "zoom" mode, you can select the top left corner you wish to look at, depress the mouse button, drag the cursor to the bottom right corner you wish to look at, and when the button is released, the graph will change to fill that screen with the area you defined. Note that the shape of the zoom area is fixed due to the scaling of the axes. If the mouse button is double clicked in the window, it will return to normal full view. The 3D window is different, and zooms are achieved by use of the "Zoom In" and "Zoom Out" buttons. A double click in the 3D view will

return this view to its original state. The shape of the zoom box is controlled by the scaling on the axes, and you can only set the size of the zoom window, not its shape.
Rmv Graph: When clicked, the current graph will disappear so that the remaining graphs can be more closely inspected.
Flip Screen: Used to switch between viewing the one graph you are on and all the graphs.

Additional Zoom and Dolly:
You can also Zoom and Dolly in the 3D displays using the mouse and holding down the "Alt" key. When the Alt key is depressed, the mouse Middle button will allow you to dolly the graph around (holding down Shift as well locks one dimension). If you hold down the Left and Middle mouse buttons, moving the mouse will zoom the display. This is similar to the Maya™ interface.

Edit Point:
Move Waypoint: This allows the user to pick up a 3D waypoint on one of the 2D representations and move it to another position. When the mouse button is clicked, you will "pick up" the closest waypoint on the closer path, and then a green box will appear to show where you are moving it to, and as you move it around, the co-ordinates or where you are moving it to will show in the top left hand corner of the screen. When the waypoint is placed, then the paths on all 3 2D representations will be recalculated and re-drawn to reflect the change you have made. Note that it is easily possibly to move a waypoint to a non attainable position. E.G. you could lift the camera to 2 metres off the floor, but not have a rig that can achieve this height. Editing in this display should be done with understanding and caution. If the point jumps to a different position than the one you have moved it to, then you are either moving it to a position that the rig cannot attain, or the maths has found a different solution than expected to the positions you have dictated, in this case, you are probably moving a point more than you should. Target Tracking moves should be entered in the standard way, and only minor editing should be done in this manner. Warnings may appear on screen if a point is moved outside of the stated envelope of the rig. If this occurs, then check the 3D co-ordinate limits in the "Carts Set-ups" and either move the point to within the operating envelope of the rig, or correct these limits.
The other mouse buttons are non functional in this mode.

Edit Control:
Move Control**:** When you are using Bezier curves or Quick Cubics, you can control the shape of the move path without moving the waypoints. This is handled by using what are called control points. Each waypoint has 2 control points that affect the shape of the path as it arrives at and as it leaves that point. The distance of the control point from the waypoint can be adjusted in Beziers and not cubics and affects the tightness of the curve at that point. The slope of the line from the control point to the waypoint affects the shape of the path as the waypoint is approached and as it is left. Plot some simple moves and experiment with these to see how they react. As with moving waypoint, you can cause odd effects if you get too ambitious with your editing, so it is a good idea to try to achieve an actual intended change to the move rather than just play around. As the control points are moved, a line of dots appear to show you what the resultant change to the graph would be. The end waypoints only have one control point.
Reset Point: Resets the controls points of the nearest waypoint back to a default shape.

Reset Path: Resets all the control points of the nearest path.

Zoom In and Zoom Out:
These affect only the 3 dimensional display and allow you to look closer at the move, or view it from further away. Double clicking the mouse select button when in the 3-D graph will return it to the original view.

Display Targs:
You can remove and replace any graph, allowing you to look more closely at any one of the 4 representations as you desire, when this button is selected, a dialogue box of the 4 graphs available is displayed and if you select one that is not currently on screen, the screen will redraw with that graph(s) displayed.

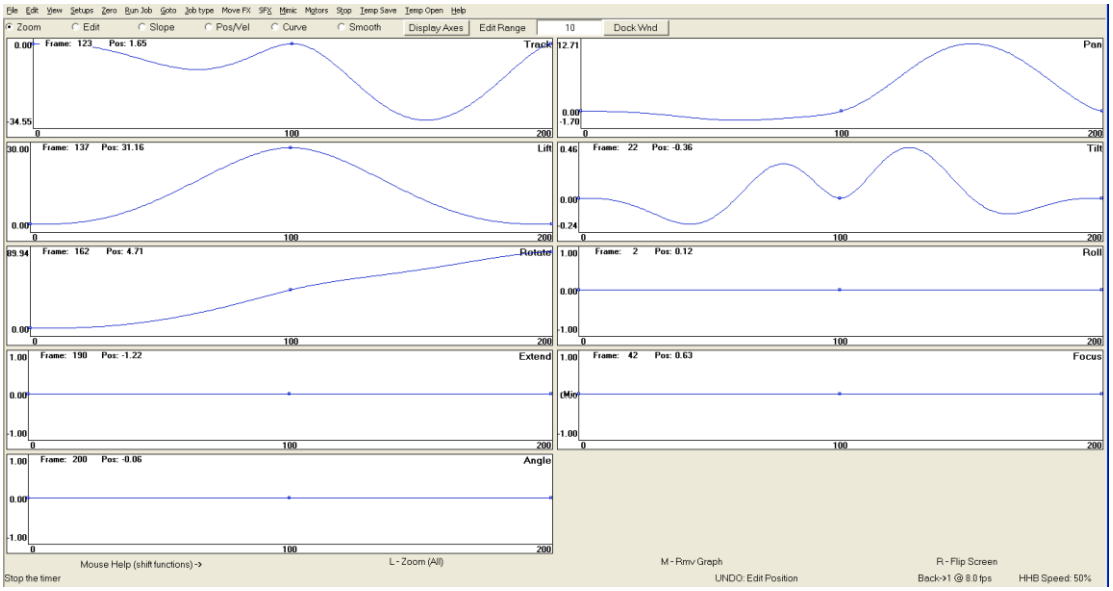
Dock Wnd:
This feature allows you to "tear off" the graphics display as a separate window. This is only really useful if you have a dual monitor display and then any of the main graphics windows can be docked or undocked. When undocked, then the move can be run and the graphics display will have some indication of the motion of the move as you go. This can be very helpful in fine tuning the editing of the move and is not available when the window is docked. The window may be docked again by pressing this button a second time.

Additional Features:
You can change the viewing point that you observe the move from in the 3-D View graph by using the mouse. Depress the mouse select button, and move the mouse in the direction you wish to move the viewing point. If you move the mouse up with the button pressed and then release it, you will see the move from a higher position, if you move the mouse to either side, you will view the move from a different orientation.

View Manipulation:
You can use the mouse to move the image in the graph. These control are based loosely on those in Maya(tm). One can dolly the view up/down and left/right by pressing the "Alt" button and holding down the middle mouse button while moving the mouse. Zooming is down by holding down the "Alt" button and holding the left and middle mouse buttons while moving the mouse. Rolling the view around the centre of the screen (tumbling) can be done in 3D views using the "Alt" and moving the mouse with the left button depressed.

Cartesian Graphics:

The Cartesian axes (X Camera, Y Camera, Z Camera and X Target, Y Target & Z Target or Pan, Tilt & Roll, Xup Yup and Zup, Lens Focal length, Interocular distance and Convergence) can be graphed against time in the same way that an axis position can be graphed against time. These graphs can be edited and modified in exactly the same way that the axis positions can be edited. See that section of the manual for details. When in PTR Target Tracking, the target graphs are replaced by Pan, Tilt and Roll. There is a potential confusion here as these are NOT the same as the axes: Pan, Tilt and Roll. These are the orientation of the camera in space which is a composite of the mechanical pan, tilt and roll axes as well as the other axes, particularly the Angle (or Outer Arm) axis on a Milo or Cyclops Motion Control Rig.



Adding points on the Cartesian graphics display will add a blank line with a waypoint on it for only that axis. As covered above, this is not recommended practice. Nor is deleting waypoints for one Cartesian axis.

Controls in the Cartesian Graphics are identical to those in the Axis graphics and are not described here,

Reverse Kinematics and Cart/Axis priority

The whole principle of reverse kinematics basically depends on working out from the position of the camera and target (or camera orientation in the studio) where each axis of the rig is. This subject is complicated when you have more axes than you have data to start with and is also complicated by there being more than one way to get a camera to be in one position and to look in a certain direction. Imagine a camera looking forwards - now pan through 180 degrees and tilt down through 180 degrees and you are in the same place, looking in the same direction. (Although rolled 180). Both of these are acceptable solutions to the reverse kinematics, but you cannot just jump from one to the other. There is considerable math inside of the software to keep track of such things.

Now imagine a target tracking move that is plotted with the camera at 0 and a target of 100.00 units at frame 0; at frame one there is a waypoint with a target of 100.00 and the pan and tilt are both at -180. If you run this move out of target tracking, the pan and tilt will move backwards and forwards as you run the move. If you run it in Target Tracking, the camera will remain still throughout the move as, as far as it is concerned, neither the camera nor the target has changed position. Now press back run and see what happens? The camera will ask for and execute a goto to the entered end positions and when the move is run will stay in that position. Again, the same camera position and orientation, but a different set of axis positions. (Assuming you are in keep horizon level).

Some users have run into this. The phenomena is that the rig will do a massive goto at each end of the move and will even do a large goto if you stop it in the middle, the

camera usually seems to be in the right place, but the axis are in different positions than you would expect. If you ran the move to the end and then stored the end positions to the actual motor positions at the end of the move, that would handle it. However, there is also the question of mid points and the basic problem with those is that if you stop at them, the rig will immediately do its goto and that will cause you no end of trouble! The rig is not finding the wrong solution, it is finding the closest solution to the entered positions at the closest waypoint. The handling for this is to change the positions at the waypoint and it will correct the problem.

This is done by clicking the mouse on the push button “Convert” to the right of the “Priority to Axis Positions/Cartesians” toggle in the job type display. When you do this, a dialogue will appear asking if you want to “Regenerate axis positions based on Cartesian data”. When you click “Yes” the computer will take a few seconds to walk through the move and store the positions of each waypoint to the correct axis positions as though you were doing a full forward run. When the process is complete, you will be informed that the move has been modified to fit the reverse kinematics. You are very definitely recommended to save the job before you do this, it is a non reversible process and could cause some unwanted result - if it does, please send the move to MRMC so that we can check it out and find out what occurred.

Perhaps it is fitting here to add some data on the use of Cart Priority/Axis Priority. The potential uses of this are perhaps more extensive than it would first appear. Take for example shooting 2 different sets for an effects shot that have to be matched together. They could be scaled, but for the sake of argument let’s say they are the same scale. One of these sets has to be shot on a periscope due to the restrictions of the model; the other cannot be shot on the periscope due to lighting and live action considerations. Under normal circumstances, you are in trouble. However; select cart priority with the periscope move fully calculated up and then switch the periscope/snorkel off and select a prime lens (same focal length!) and ensure that the nodal offsets are correct. When you run this move, the rig will move the camera to match the position and orientation produced by the periscope, but now it has a prime lens, and you will get the same actual lens motion but with a different rig configuration. Obviously, this is going to be as close to a perfect match as the rig is perfectly accurate and the lenses perfectly set up. You have to be the judge of what the limit of the shot is and how good you have to be in matching the move exactly.

A second use of this feature is when you are importing a move. The system will automatically switch into cart priority and then you can adjust the motion of the master axes without changing the imported data at all as long as you stay in cart priority. When you have the move worked out, you can of course perform reverse kinematics based on the new positional data that you have. You additionally have the capability of adjusting the positions of the Master Axes whilst in Cartesian Priority to find the fastest speed at which the rig will run without having to move to each position, adjust in Cart Control, store and re-run!

There are other tricks that can be done using Cartesian Priority – for example if you want the tilt arm to be on the other side of the pan and still have the same camera move, you can do the following: 0) Run to the beginning of the move. 1) Switch into Cartesian Priority. 2) Add (or subtract) 180' degrees from the entered pan positions using the “ripple through” feature. 3) Change the tilt axis positions by 180, making sure you are still within the limits of the tilt axis motion. 4) Browse the move

carefully making sure that the rig runs correctly. 5) Use the "Convert" feature as above 6) Switch the priority back to Axis Positions so you can continue editing the move. You may have to change the underlying roll axis positions if you are in roll relative. The reason this works is that once you are in Cartesian Priority, the camera position is maintained, no matter where you put the Target Tracking axis positions. However, the Pan and Tilt initial positions are solved to be the closest to the entered waypoint data. This way you can force the pan and tilt to flip whilst maintaining your framing.

Editing Cartesian Priority Moves:
When you are in Cartesian Priority, changing the axis positions does not change the move. This can be a little surprising, so once you import a move or switch into Cartesian Priority, you must remember this. However, you can edit the move by changing the graphs or by storing or entering data into the Numeric Carts display. The other incidence where storing axis or Cartesian positions does not change the move is if the Cartesian is a mimic playback axis, so watch for this also if a move is not being changed as expected.

Speed Profiling:

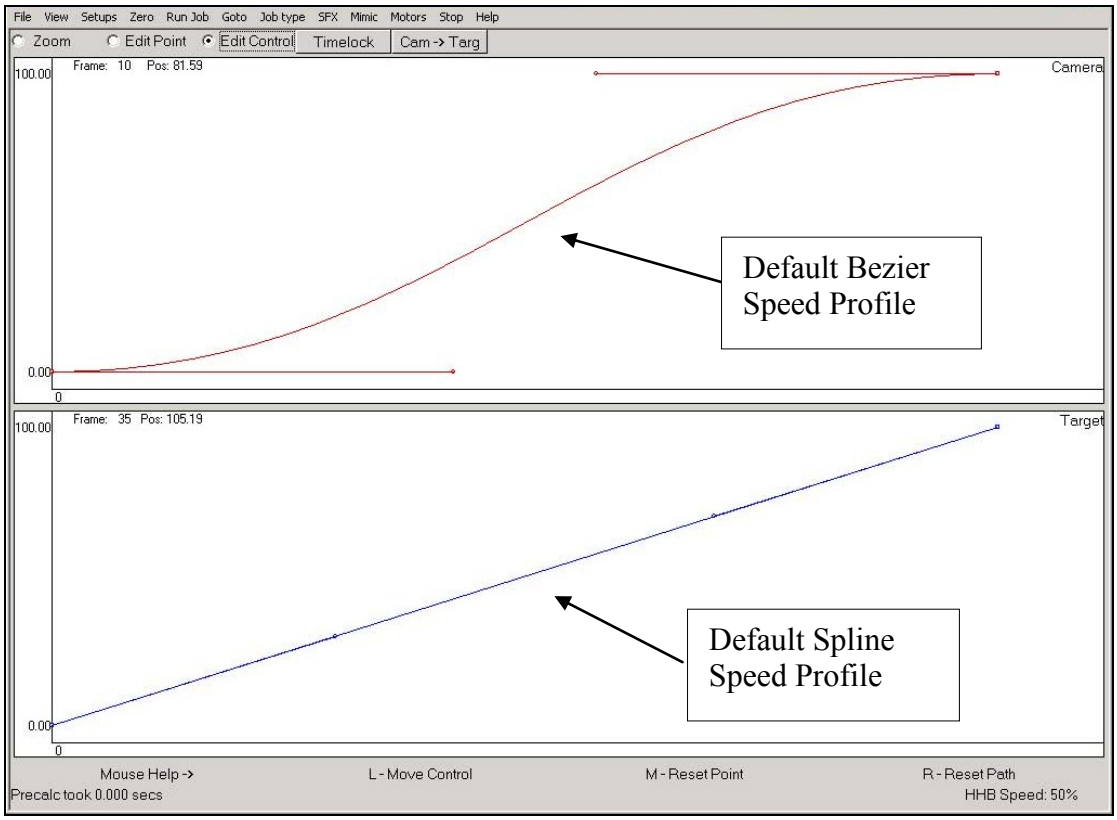
Speed profiling is a means of modifying the speed that the path is traversed without affecting the shape of the move. With the normal curve fit (splines) that is traditionally used in move generation, the shape of the path is affected, in some cases severely, by the times allotted between waypoints. Therefore if you try to change the speed by adjusting the waypoint times, you will also affect the shape of the move. Speed profiling is provided as a means to avoid this and will operate both with Bezier curves and with normal splines though it operates in different ways.

There is a potential confusion here which is to do with the shape of the curve. The move path can be created with different curves, including cubics and Bezier curves. The speed profile can also be created with cubics and Bezier curves. To make the distinction, we refer to the speed profile as being a Bezier or cubic *form* and the actual path as being a Bezier or cubic *path*.

Speed profiling can be achieved through adjusting the timing of the move (achieved with speed profiling options "Bezier Form" or "Cubic Form") or through adjusting the speed along the move, achieved with the Speed Profiling Option "Fairings Form".

Bezier Path Speed Profiling:

When you create a move path with Bezier curves, then the waypoint times are actually ignored, the only times that matter are the start and end. The move path is considered as a distance to be travelled, and the speed profile for a Bezier path is simply a graph of time along the horizontal axis against percentage of path travelled up the vertical axis (shown in frames of the move). In the default Bezier path profile, the profile starts slowly in the bottom left hand corner of the graph indicating a slow speed along the path (the profile line is almost horizontal indicating a slow change in distance over a larger change in time therefore a slow speed), then as the move progresses, the slope of the curve increases, showing increased movement along the path as the move continues, then towards the end of the move, the slope flattens off again as the speed along the path decreases to a smooth stop at the end. The gradient of the line shows the speed of travel along the move path.



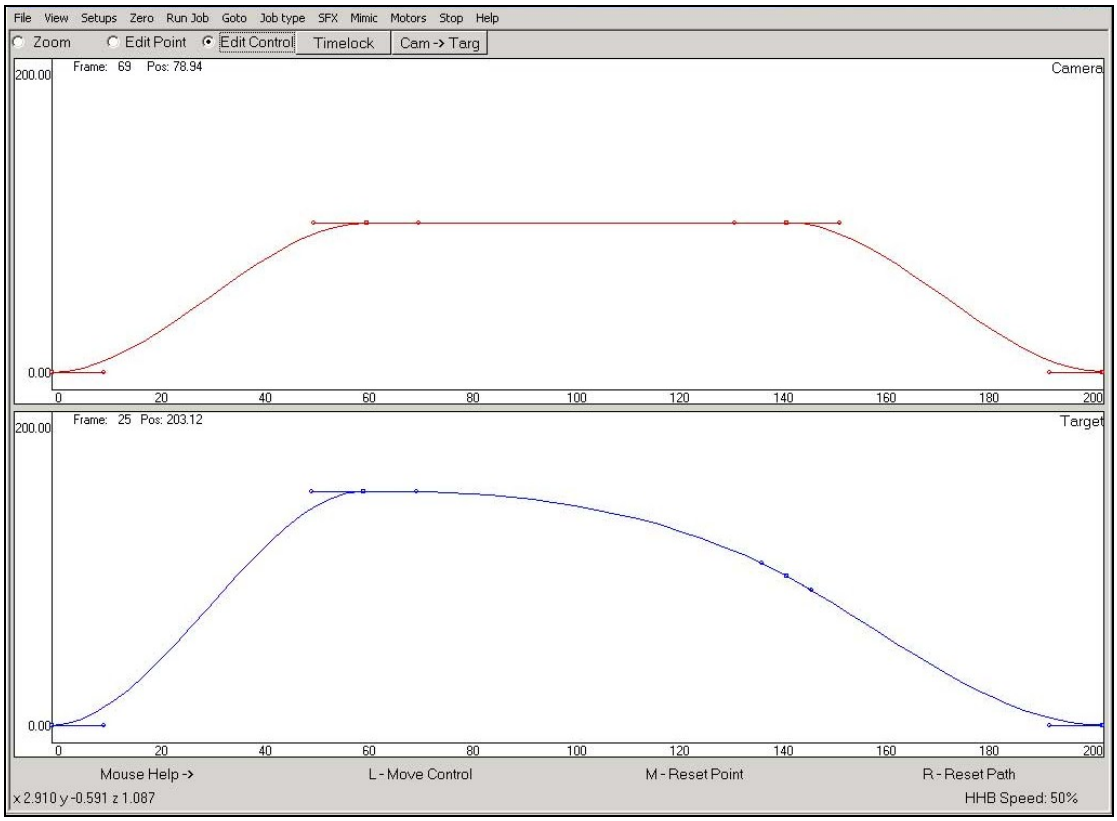
Spline Path Speed Profiling:

Splines are handled differently, and it is important to understand the difference between them. With a Bezier path, you are directly controlling the speed of the camera and target along their paths. With a spline, the speed along the path has been defined by the waypoint times, but you can affect the speed at which the move progresses. The way this is done is to control the rate at which time passes during the move. Now normally you cannot change time and its rate of change, but with Spline Path Timing Profiling, there is real time along the horizontal axes, and this passes at the rate of 1 second per second, up the vertical axis is virtual time, and the rate that this passes is controlled by the speed profile curve. The default value is to have virtual time passing at the same rate as real time, so that default graph is a straight line from bottom left to top right. If you add points to this graph and edit the graph, you can affect the speed of the camera and target along their respective paths. If you cause the curve to bow upwards, starting with a greater slope, and then flattening out, the camera (or target) will start moving along its path faster at the start, and then will slow down. As with Bezier curves, the best way to learn is to play around with it before you try to use it in a shoot. It is also possible to cause the camera or target to move along its path, change direction and move backwards, and then change again. This effect is not normally used, but gives you some idea of the flexibility of the speed control.

Fairings Form Speed Profiling:

As with other speed profiling, you can use this method of speed profiling to modify the speed of the camera or target along its path. In this representation, the graph should appear more like a velocity graph, starting usually in the bottom left corner, increasing up to a constant speed along the path, and then slowing down to the bottom right corner. This is a more normal representation of a speed profile and it also works well with holds in the move which the other form of speed profiling do not. Holds are

automatically plotted on the move as a double position on the graph at 0 which is how a hold should appear as it will occur with 0 speed. However in order to make full use of this feature, you MUST put the holds in the move before you start editing the speed profile or it will not add them to an existing speed profile. In the fairings profile, the vertical axis is relative speed, and no absolute speeds can be read off the graph.



Speed Checking:

As you modify the speed that the move path is traversed, you will also be affecting how fast the motors are running to achieve that path. If you make the speed along the path high at some points, it is possible that the motors will not be able to achieve that speed, and therefore when you try to run the move, you will have a speed error reported. The handling is to lessen the speed along that section of the path, allow more frames, or reduce the camera speed. In any case heavily profiled moves should be checked at slow speed before running them at full speed.

Speed Profile Control Buttons

Zoom:
As with the other graphs, this function allows you to define a zoom window to more closely inspect part of a graph

Flip Screen:
Used to switch between viewing the one graph you are on and all the graphs.

Edit Point

Move Waypoint: This allows the user to pick up a speed profile point and adjust its position. You cannot edit the first and last points as these are fixed. When the mouse button is clicked, you will "pick up" the closest point, and then a red box will appear to show where you are moving it to, and as you move it around, the co-ordinates of where you are moving it to will show in the top left hand corner of the screen. When the point is placed, then the speed profile is redrawn to reflect the change you have made.

Delete Waypoint: When clicked, the closest waypoint (as long as it is not the first or the last) will be deleted.

Add Waypoint: A waypoint will be added when the right mouse button is clicked at the current cursor location.

Edit Control: When you are using Bezier & Cubic Form curve fits, you can control the shape of the speed profile without moving the points. This is handled by using what are called control points. Control points are represented by hollow circles while points in the graph are shown as solid squares. Most waypoints have 2 control points that affect the shape of the profile as it approaches and as it leaves a point. With Beziers, the distance of the control point from the point affects the "tightness" or tension of the profile at that point; with Cubics you cannot change the tension. The slope of the line from the control point to the point affects the shape of the profile as the point is approached and as it is left. Plot some simple profiles and experiment with these to see how they react. The curve can go up and down the graph, but it must always move to the right as you travel its length. If the curve doubles back on itself, then the move will make large jumps as it runs.

Move Control: Allows you to pick up the control point and move it around showing you the adjusted speed profile. Please note that the curve is not allowed to go off the top or bottom of the graph and an error will be generated is you try to run such move.

Reset Point: Clicking the Middle mouse button near a point will reset the slope of that point to the default.

Reset Path: Right clicking the mouse anywhere in the graph will reset the entire profile back to the default. The default path is a gentle "S" shape for Bezier curves, and a straight line from bottom left to top right for spline curves. The default fairings form profile is a slope up, a flat section, and a slope down.

Time lock

Time lock is a feature whereby you define the speed profile such that the waypoint times - stored in the Numerical Display - are followed, but the rest of the move can be adjusted as desired. The button when pressed causes the existing move to be time locked, if you then modify the move, you will have to press this button again to make it time lock. This feature is not available on the fairings form profile as of the current release.

Speed Profile Copy

It is possible to copy the camera profile onto the target if this is desired. Simply click the "Cam → Targ" button on the top line of the display.

Errors:

In Bezier form and Cubic Form, the speed profile slope can go up and can also go down, indicating that you have reversed direction, and are going back along the path, however, the slope must never become vertical or curve back on itself. These conditions are caught by the computer on the whole, but very nearly vertical lines can cause the rig to lurch.

If you have plotted a target tracking move that follows its target nicely, but when profiled, fails to follow the target, this usually means that one of more of the set-ups on the system is incorrect. Target Tracking by itself is very forgiving, and will appear to work even if something is very wrong, speed profiling however is not so forgiving. If this happens, check the 3D displays to see if you can spot any obvious discrepancies and check the lens Set-up and possibly even the kinematics Set-up. Correction of errors in the target tracking Set-up requires careful elimination and testing and is best done with assistance from Mark Roberts Motion Control.

Cartesian Control

Principle:

Cartesian Control allows the user to move the camera or target around just as though it were a point in space while always keeping the camera pointed towards the target, and can greatly facilitate inputting a target tracking move. The camera point can be moved around to desired waypoints, these can be stored as per normal, and then the move can be executed either in or out of Target Tracking. The system does not have to be in Target Tracking for Cartesian Control to work.

Once Cartesian Control has been initialised and switched on, the Hand Held Box controls directly move the camera nodal point or the target in X, Y and Z directions. There are 3 types of Cartesian Control: "World", "View" and "Roll".

World

In World Relative Cartesian Control, using the X button will move the camera nodal point in the X axis direction which is parallel to the track of the rig, using Y will move the camera side to side at right angles to the track. If you use the Z button, the camera will move vertically up and down. The same applies for the XYZ buttons that control the Target Point. If you move the camera nodal point, the camera will follow the target as the camera moves around, if you move the target point, then the camera will follow it.

View

In View relative mode, the control is similar except that the axes are relative to the viewing direction. This means that the X direction is towards the target, the Y direction is side to side and the Z direction is up and down. For example if you were pointing directly at a target and pressed the Y Camera button and held it down, the camera would swing right round the target following it all the way round. If you use the X button, then you can zoom in and out of the target. The XYZ movements also apply to the target, but since the target is a virtual point rather than a real point like the

camera, it can be tricky to control this effectively. Please note that the roll position does not affect the directions you move in, so you have to look at the rig, not necessarily the monitor when using this control.

Roll
In roll mode, the concept is very similar to the view mode except that the axes are adjusted depending on the position of the roll axis and so if you move using the Y button, the image on the screen should slide side to side regardless of the orientation of the roll orientation of the camera.

Locked World
In this mode, the camera is moved around as in the world mode, but the target point moves with the camera. This means that if you move the camera to one side, the target moves as well. The Target motion is as in the View relative mode, and the target can be panned and tilted around. The focus button can be used to drive the target away from and toward the camera.

Locked View
Locked View is like Locked World except that the directions that the camera move in is dependent on the orientation of the camera. The best thing to do is to try it out and see what it does. It is a cross between "View" and "Locked World"

Locked Roll
This is basically the “Locked” principle applied to the “Roll Mode”.

As with many other parts of the software, the best way to find out about this is to try it out and see what it does. Roll and Locked roll methods are best used with Horizon Relative. They will work in horizon level (but then it is the same as View and Locked View) and it will work with horizon independent, but then the orientation of the camera changes, and you get an arcing effect.

Caveat
There are a couple of situations that can cause the rig to move very suddenly when in Cartesian Control, ands these should be understood and avoided. 1) Never drive the View Point of the Camera into the Target point; the camera will attempt to turn through 180 degrees instantly and the rig will lurch. 2) Unless you are sure you know what you are doing, do not let the rotate get more than about 75-80 degrees from straight ahead or straight back. When you the rotate approaches 90 degrees, the track will move very fast, and this will also affect the quality of the move. Extend the arm out, or use the Angle if you have one. You can also drive the target point through the view point if you lens is not set up correctly and you pull focus to move the target closer to the camera. This will only happen if you have not set your focus limits correctly.

Master Axes
When you are in any of the Cartesian Control Modes, the master axes are still active as usual on the hand held box, but moving them does not affect the position of the camera. The result of this is that if you move a master axis, the other axes will compensate to hold the camera nodal point and target position stationary. This is quite fun to play with, but it also has a use in that you can re-configure the rig for lighting or speed reasons without changing the framing or move path when in Target Tracking.

Please do note the warnings and limitation listed below. When you do this, you may notice that there is a slight lag in the compensation, this is only 1/50 of a second, and will not occur during any move.

Initialisation

Initialisation of Cartesian Control occurs when you switch it on. Turn on Cart Control by selecting the pull down and choose from “Carts Off”, “Carts World”, "Carts View", "Carts Roll", "Locked World”, "Locked View" and "Locked Roll". Select the option you want and the system may request a small “Goto”, if this is executed, you will then be in Cartesian Control. This will be reflected by a line in the bottom of the LCD on the Hand Held Box.

If you are using Cartesian Control and moving the target, then it is best to have the focus axis in one of the computer controlled modes as this makes the positioning of the target easier.

Control Assignments

The XYZ controls are achieved by the buttons that control the motion most similar to the one you are trying to achieve. i.e. Track will move the camera in X, Rotate will move it in Y, Lift will move it in Z. The target is moved in X by the Focus Button, Y by the Pan button and Z by the Tilt Button. Master axes are controlled as per normal but note that as you move a master axis, the other axes will move to hold the camera stationary as you are not actually moving the XYZ of the camera. The Hand Held Box should indicate which form of Cartesian Control you are in. Master Axes are most commonly found on "Milo" and "Cyclops" rigs. In some kinematics models, there are options as to which axes are master axes and which are target tracking. This will change the operation of the buttons on the hand held box, so please note this and get used to the response in different modes.

Control by Handwheels

If you have an axis controlled in Encoder Velocity Mode that would otherwise move a Cartesian axis, you can use the handwheel to control it. It will be active whenever you are in Cartesian Control and the Hand Held Box is on. If you are controlling Pan and Tilt in Encoder Vel mode (the most likely use) then the axis speeds of the Pan and Tilt are limited based on the Pan and Tilt Hand Held Box velocities. Note that this is different from the normal Pan and Tilt velocities when in Encoder Vel mode. This is for safety as in Cartesian Control, the rig moves around to compensate to hold the nodal point stationary as you pan and tilt.

Limits

There are positional limits in the Cartesian Set-up display, but as mentioned in the Chapter on Set-up, these do not detect every condition and it is better to know the limitation of your rig and exercise caution when moving the rig around. The Cartesian limits do not work very well as of Version 5.11 and so should be set to large numbers.

Positional Readout

In Cartesian Control some of the axis positions are replaced by the related Cartesian Co-ordinates of the Camera and Target. If an axis position appears in red, then it is showing that it is a Cartesian position, not a true axis position. If the position in red is above one of the large axis such as Track, Lift or Rotate, then it is the XYZ co-ordinate of the Camera (per the above axis alignment). The positions above the Pan

and Tilt are actual studio pan and tilt angles. (e.g. if the arm is rotated to 20 degrees and the camera is panned to 30 degrees, the actual studio pan angle is 50 degrees as the pan and rotate both pan the camera, but in different ways.) This is particularly helpful if you have an Angle axis and are not in keep head level.

Warnings and Limitations:

The use of Cartesian Control is an advanced feature and only experienced users should attempt it. In this mode, you can enter Cartesian soft limits in the Carts Set-ups box as well as control Cartesian velocities and accelerations, but in the current release, the system is NOT aware of axis limits and will bypass all Target Tracking axis soft limits. In addition, the restrictions and limitations that apply to Target Tracking apply to Cartesian Control with the added warning that the rig will attempt to resolve Tilt90 and Rotate90 situations with possibly violent movements of the pan, tilt and track axes. You must not get close to these situations when in Cartesian Control and also must not drive the camera point to or through the target point. Should any of the above situation occur, it is very likely that Cartesian Control will be switched off. Having said this, with a practised eye and some understanding of these limitations and 3 dimensional space, Cartesian Control can be extremely useful is setting up moves that might otherwise involve a lot of multi axis manipulation just to achieve certain framings and positioning.

Turning Off Cartesian Control

Cartesian control can be turned off simply by going into the "Side Menu Control Menu" and switching the Cartesian Control selection to "Carts Off" and then moving the mouse out of the Menu Bar. Cart Control will also turn off if any axis attempts to jump violently as can happen if the above restrictions are not obeyed. It will also turn off if you attempt any form of Goto or Move running. These modes of control are mutually exclusive.

Magellan Space Mouse ™

Some development work has been done to be able to move the rig around in Cartesian control from a 6 axis controller. The Magellan Space Mouse can be used for this and if you wish to try this out, contact MRMC for details.

Table Target Tracking

There is a kinematics model that is significantly different in its approach to target tracking to warrant a fuller description than the other methods. Since there is no pan and tilt on an Animation table, the position of the target is somewhat irrelevant and does not really concern us. The use of Target Tracking with an animation stand would be in the ability to view and edit composite graphs of motion. When you have an animation stand moving a piece of art work around and moving the camera closer to it and further away, you could regard this as simple moving the camera around above a flat table. This way of viewing it immediately gives one the camera motion part of Target Tracking and opens up the full extent of target tracking features such as cart control and graphics display and editing, as well as speed profiling.

PTR Target Tracking will not work, nor will scaling, but the rest of the features of target tracking should be fully available. Being able to view the 3D motion of the camera relative to the artwork can reveal the more direct effects of moving points around in space. Also having the rotate axis modelled in the software will allow one to use it more fully. For example if you want to turn about a part of an artwork that is

off centre of the table, it is almost impossible. With target tracking on, one should simply be able to rotate in Cart Control with the current image held in the centre of the lens and then plot the 2 points and because the camera does not move relative to the art work, the target tracking axes (N/W and E/W) should compensate for the Master axis Rotate. (From this one can deduce that Track, N/S and E/W must be assigned as Target Tracking axes and that Rotate must be a Master axis in the axis Set-ups).

Table Auto Focus

Auto focus is not really a target tracking concern, but since there are similarities, it is being covered in this section of the manual. Auto focus gives one the ability to move a camera closer and further from a piece of artwork but to keep the image sharply focused. Since standard Target Tracking can also do this in a similar way, there are similarities and differences here. You do not need to have Target Tracking switched on for auto focus to work.

When auto focus is engaged, the computer derives the position of the carriage and the focus motor based on the Set-ups and a notional camera height and a notional image height. As one uses the hand held box buttons to move the carriage and/or focus, the computer is actually moving a notional camera height and a notional image height and moving the camera and focus based on these. These notional heights above the table are displayed on the screen in red in the Track and Focus axis columns. Switching in and out of auto focus changes between the two modes. The track position and column of positional data actually reflects the notional camera height above the table in the measure units that the system is set for (usually inches or centimetres). The focus position and column of positional data reflects the height of the object (target) relative to the table. This value would normally be 0.0 and stay that way, but you can use this feature to pull focus onto thick objects placed on the table, or to pull an image in or out of focus should this be desired. When autofocus is switched off and then on again, the focus will shift back to the table top.

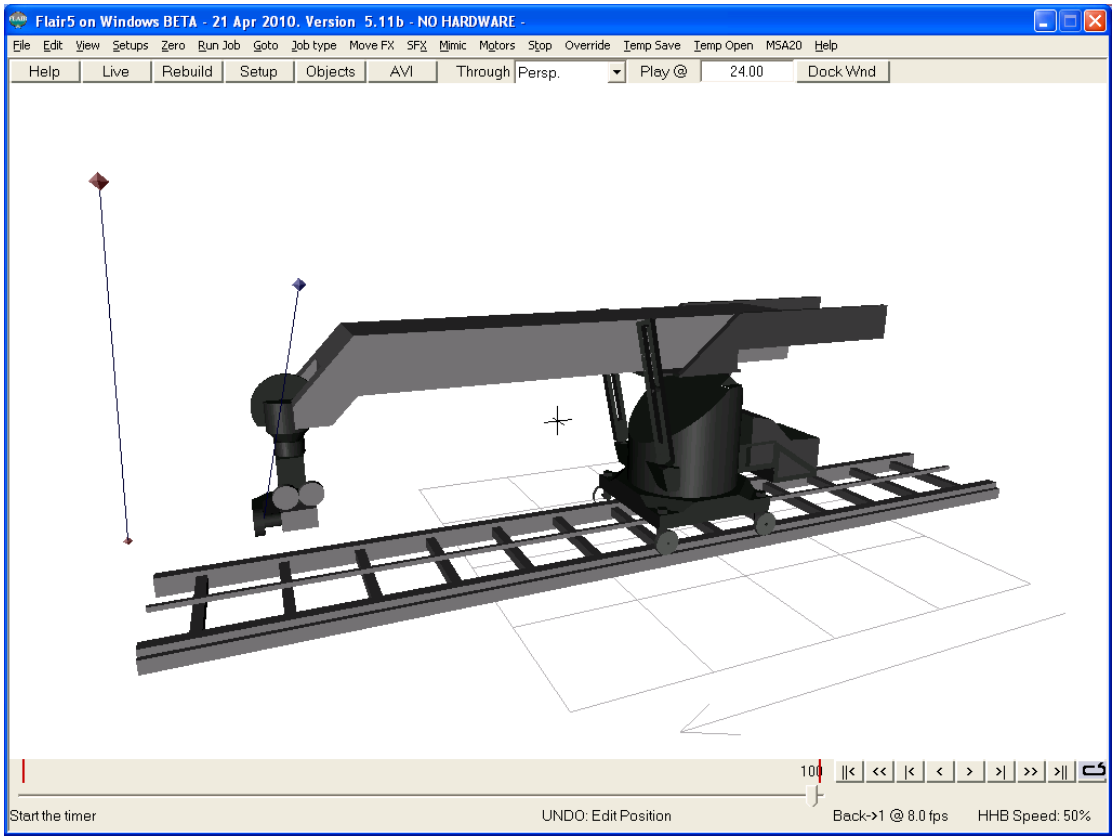
When you switch on autofocus, the computer looks at the current positions of the carriage and the lens and works out the height of the lens above the table based on that data, it then pulls focus on the table with the lens at that height. Moving the axis up and down in autofocus adjusts that height above the table. The limits on the travel are restricted by how low the carriage can go and also by how extended the bellows on the camera can be (with a moving lens). Whilst every care has been taken to make these limits safe, you should always approach the table with care and generally not at top speed. The top limit is generally restricted by the carriage as in most cases the lens should be able to go to infinity focus. If the maximum height of the carriage is restricted by the motion of the lens, then the user will have to watch this as it is not accounted for in the software.

Exponential Motion

Another feature of this which is automated is the ability to use the height of the camera above the table to determine what exponential move will produce a uniform rate of change of field size. This can be easily done by selecting “Auto Exp Off” to “Auto Exp On” The toggle is right below the auto focus toggle. The exponential ratio will be used in the motion of all Table related axes, but only works with those axes that are executing a 2 point move. The greater the ratio of field sizes (camera heights) the greater the speed of the camera when it is higher.

CHAPTER 12 – RIG MODEL DISPLAY

Since Flair can run in a stand-alone mode with no rig attached, it is invaluable to have some representation of what the rig would be doing in any given move. The Rig Model display provides that and much more.


Flair5 on Windows BETA - 21 Apr 2010. Version 5.11b - NO HARDWARE -
File Edit View Setups Zero Run Job Goto Job type Move FX SFX Mimic Motors Stop Override Temp Save Temp Open MSA20 Help
Help Live Rebuild Setup Objects AVI Through Persp. Play @ 24.00 Dock Wnd
Start the timer
UNDO: Edit Position
Back->1 @ 8.0 fps
HHB Speed: 50%

The display is a 3D view that allows you to view the rig through a Perspective or Orthogonal camera as well as being able to view through the camera mounted on the rig. Many of the rig designs that are used with Flair are supported and carefully picking your kinematics model will assist in making sure that the rig is properly displayed.

Supported Models are: Milo, Talos, Modula, Animoko, UltiHead, Staubli, Technocrane, Simple Dolly and Hexapod.

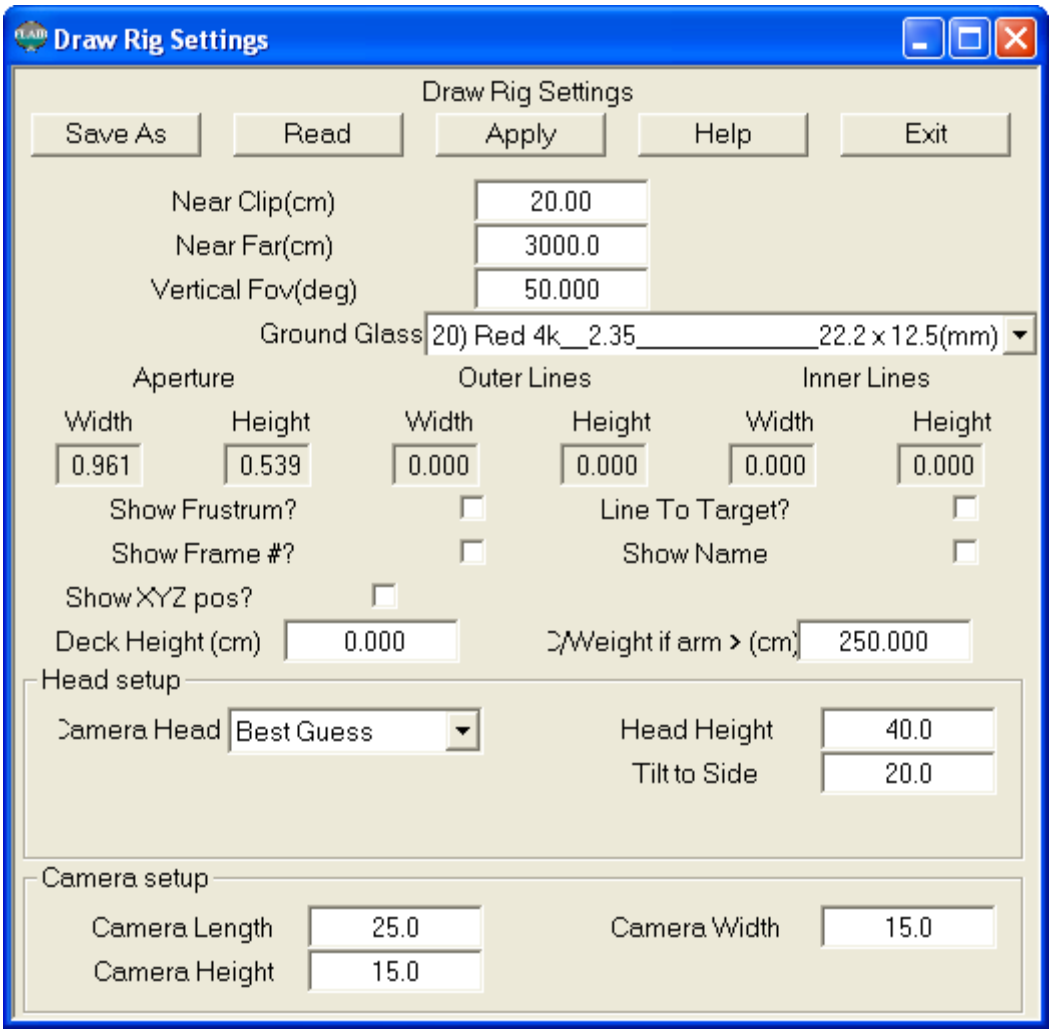
Rig Model Menu Bar:

Help: A brief description of the control available when you are in the rig model display.

Live: Sets the displayed rig to follow the actual rig positions as it is moved in real time. This is useful as you can move the actual rig through this display with a small control panel which pops up when you are in this mode. However it is not recommended as you should be watching the rig if one is attached and not the screen!

Rebuild: Refreshes the display with any recent changes that have been made.

Setup: Configures the display in terms of clipping planes, ground glass and details of the displayed rig.



Save As: Allows you to save your settings into a .ini file for later review and or use.

Read: Opens a File Dialog box to select an appropriate .ini file to read in. See Advance Configuration for more data about .ini files and what settings can be saved with them.

Near Clip & Far Clip: Defines the clipping planes to be used in all modes in centimetres

Vertical Fov (Degrees): Defines the angle of view used by the system when you view in the Perspective or Orthogonal views. The angle of view of the rig view is controlled by the lens settings.

Ground Glass: Selects from a wide variety of choices which ground glass should be used in the Rig display mode. (When you are looking through the rig's lens). This gives a very good guide to what you might actually seen on the video assist or camera monitor in terms of markings and viewable area. The various choices are self explanatory. In many cases, the actual image area is given in terms of the viewed

area's height and width in inches of millimetres. Inches were the norm for film cameras, and now HD chips tend to use millimetres. You can choose selection 0 which is a Custom Ground glass and allows you to define the ground glass in Inches.

Aperture, Outer Lines, Inner Lines: Width and Height
These 6 boxes allow you to define the custom ground glass is selected in Inches giving the outer aperture, and optionally 2 inner markings such as A safe area and a 4:3 area to be protected. If in doubt you will have to get in touch with the manufacturer of the Camera to get these exact details.

Show Frustum: When selected a frustum giving the outer corners of the viewed area is projected into the Perspective and Orthogonal displays.

Line to Target: Adds a viewing line from the camera to the target which can assist in seeing what the camera is doing.

Show Frame #: Displays the current move frame count on the Perspective and Orthogonal displays

Show Name: If there is a name in the CGI export, then this can be burned into the display.

Show XYZ Pos: Burns the current camera position into the display. If in Normal target Tracking the camera and target position is shown if in PTR Target Tracking, the camera position and orientation is shown.

Deck Height (cm): Defines a deck height to be placed under the rig if the rig is not mounted on the floor. This looks good at first sight, but it not fully integrated into the kinematics and should not be used.

C/Weight if arm > (cm): Milo Motion control rigs only use counter weights when the arm is longer than normal. This setting tells the display when counterweights should be added to the Milo Rig Model. It is non functional with all other rig models.

Head Setup: Various heads can be used with motion control rigs. Which head you use and how it is connected can be adjusted here. The Rig modelling is under development at this time and this display may be superseded or improved. You can currently define which head is attached to your motion control rig, or have the system make a good guess based on your kinematics offsets as to which head it is.

Head Height: Is used to define the offset from the top of the pan to the tilt axis as this is not in itself defined in the kinematics.

Tilt to Side: Not currently used, but the same concept of how far to the side of the pan centre the tilt arm is positioned.

Camera Setup: Cameras are currently represented as a simple box and tube which is defined here. Future enhancements may include models of the most popular camera bodies.

Objects:

Controls the appearance of a few objects that can be placed in the scene and viewed. Flair is not a full blown CGI system, but a view through the lens of the camera is not a whole lot of use unless there is something there to look at. This display provides 3 simple coloured cubes that can be moved around and viewed through the lens. The cubes and Red, Green and Blue and default to approximately the size of a man, a car and a large table respectively.

Import Scene: Allows the user to open an FBX scene file and navigate the tree of objects selecting specific object to import. Currently under development.

Red Cube, Green Cube, Red Cube: Checking these will select which ones are displayed.

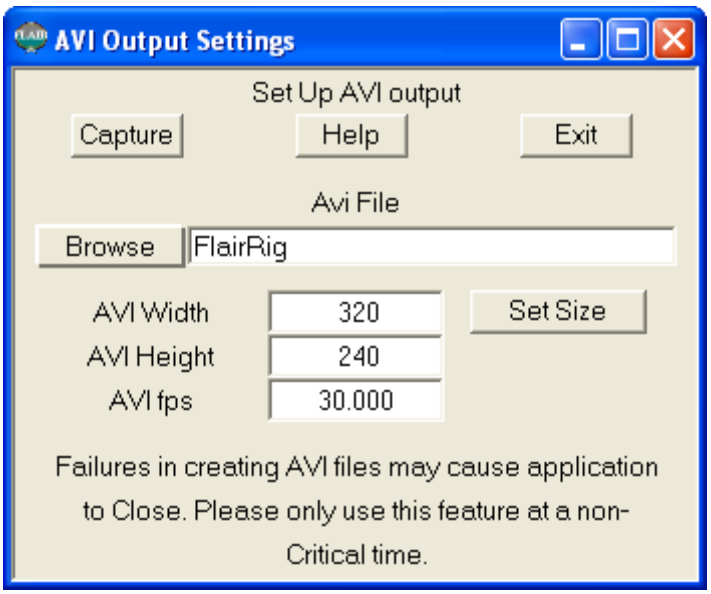
Size (cm): The length, height and depth of these cubes can be type in centimetres.

Position (cm): The position of the cubes in centimetres.

Rotation: For the sake of simplicity, only rotations about the vertical axis are allowed. These are defined in degrees and occur about the corner of the cube defined by the "Position" entry.

AVI:

It is often useful to be able to show a prospective client exactly how the rig would do a specific move. If you can program the move or import it from CG, then the rig display can be used to export the motion of the camera as an AVI file. Set up whichever display you want to export and press the AVI button. You will be prompted for a filename to save it as well as a size of the screen and a frame rate. Once these are set and the "Capture" button is pressed you will be asked to select from the various codecs that are installed on your machine. This is machine specific and you should choose the one that is most commonly available followed by the one which gives best compression. H264 is a good choice if it is available. Uncompressed files are generally huge! "Set Size" will cause the AVI to be as big as the current rig display



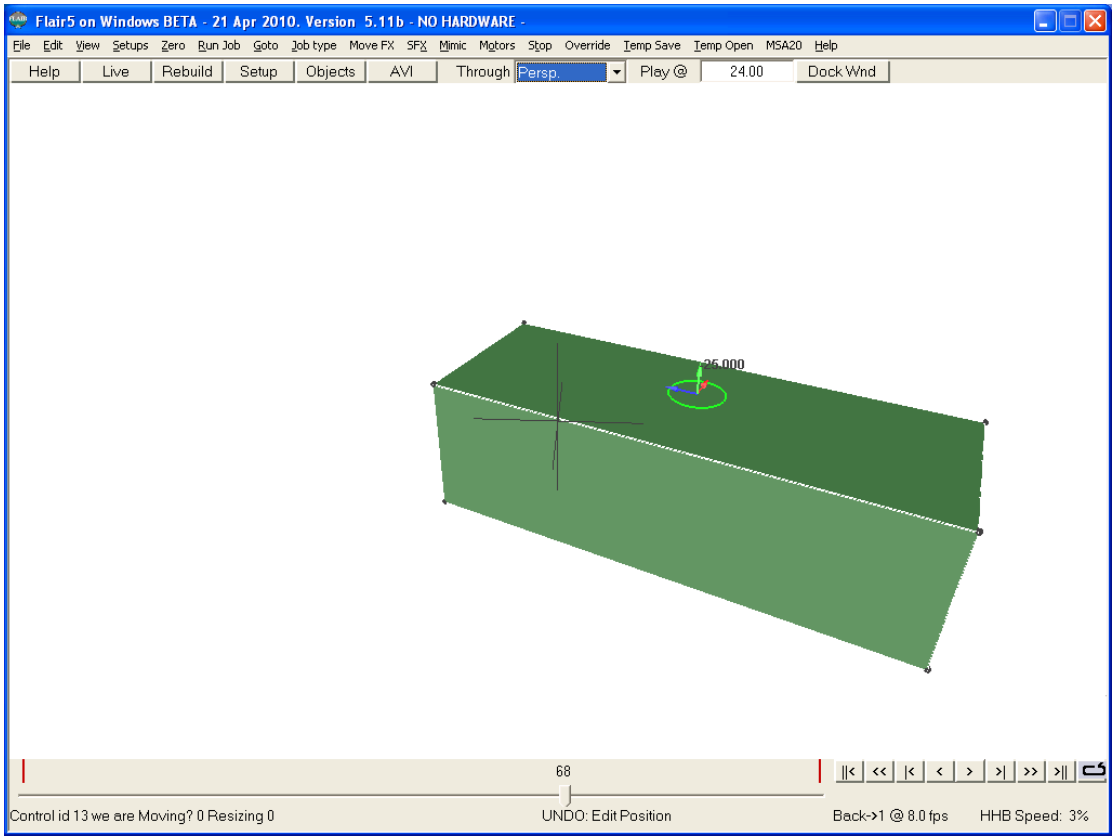
Through: This defines the camera through which you are looking. The default is a perspective camera ("Persp.")which may be moved around the scene as desired much as the perspective camera can be moved around in the 3D Graphics display. The interface for moving the camera around has 3 basic actions which are controlled by holding down the Alt key and a combination of Mouse Buttons. Left Button is Orbit, Middle is Dolly, Left and Middle (Or Right) is Zoom. In Orbit and Dolly mode, the movement of the mouse is matched by an appropriate Dolly or Orbit. In Zoom mode movement of the mouse to the left and up zooms in and to the right and down zooms out. You can also look through a perspective camera, "Top", "Front" or "Side". In these orientation, Orbit is not a valid option and you can only Dolly and Zoom. The final option is "Rig" and this makes you look through the camera mounted on the rig. In this mode, no camera motion is valid as the camera position is defined by the programmed move. In this display, the ground glass becomes effective and if Outer and Inner lines are configured, they are shown in the window.

Play @: When a move is being run, you can see the rig run though at the programmed speed of the move. Sometime however, the camera is very slow or very fast and it is not easy to visualize what is happening in parts of the move. "Play @" allows you to keep the camera speed the same in the move, but to watch the motion of the rig at a different speed.

Dock Wnd: This is covered earlier in the manual; allows you to "Tear Off" the window and set it up in its own frame so you can move it around the screen independent of the Flair window and also allows you to watch the window as the move is being controlled by the main Flair window. The most likely use of this would be to put it in a secondary monitor on the system to see what the rig is doing during the move. Again, please be sure to watch the rig as it runs and not the display as the camera moves.

Orthogonal/Perspective Views: In these views you can see the Camera, Target and Up points as well as the cubes and the entire rig. You can see the rig run through its move using the slider controls or the slider bar and note if the rig goes out of position of over speed, seeing which axis and where in the move this occurs. This is very useful for fixing moves that are too fast without having to actually move the rig. If the rig goes over position, the relevant axis will turn red, blue for over speed and green for over acceleration. If the rig just flashes a warning colour for a moment, you can drag the slider and see exactly where it is going out of limit and at which frame count.

Object Manipulation: The 3 cubes can also be adjusted in their position, orientation and size in these displays. Simply click on the cube you want to adjust and small black locator cubes will appear at the corners which allow you to resize the cube and a translation rotation control appears in the middle. The three orthogonal arrows allow for translation and the round allows for rotation about the Y (vertical axis) As the cube is adjusted, the value that is being changed is displayed


Flair5 on Windows BETA - 21 Apr 2010. Version 5.11b - NO HARDWARE -
File Edit View Setups Zero Run Job Goto Job type Move FX SFX Mimic Motors Stop Override Temp Save Temp Open MSA20 Help
Help Live Rebuild Setup Objects AVI Through Persp. Play @ 24.00 Dock Wnd
68
Control id 13 we are Moving? 0 Resizing 0
UNDO: Edit Position
Back->1 @ 8.0 fps
HHB Speed: 3%

As the object are manipulated, their values are updated in the "Object Setup" display and changes can be saved to an .ini file so specific set ups can be re-created easily.

Rig Position: The position of the rig can either be the current rig position or it can be a position on the move. Usually when you switch into this display, the current camera and rig position is shown. As soon as you use the time-line bar or the run controls, the rig's position on the move is show.

Time-line: The time-line is similar to the main numeric display time-line in that it shows the frame count of the current rig position, and can be used to drag the rig along its path by pulling the slider left and right. Waypoints are shown along the time-line as vertical red bars if there are only a few waypoints. With too many, it gets cluttered and so if there are more than 500 nothing is shown. If you right click on the time-line slider just beneath a key, you will get a small context menu with the options "Store Key", "Disable Key" and Goto Frame xx" where xx is the frame count of the waypoint/keyframe. The left and right cursor keys can be used to jog the slider up and down the move timeline, and click to the left or right will cause it to jump one frame either way.

Run Control: The run controls are just to the right of the Slider Bar and consist of 9 buttons

The ||< and >|| keys will drive the rig to one end of the move.
|< and >| cause it to jump to the next keyframe.

< and > play the move forwards and backwards
The middle mouse button anywhere in the screen acts as a stop button.
The final loop button causes the rug to run through the move on a loop when selected.

These buttons control the motion of the rig model and NOT the rig on the move.

Pre-rolls and Post-rolls
Since rig pre-roll and post-roll is an important part of safely running a move, any time a pre-roll or post-roll is needed by the rig, the rig model will also show you the same pre-roll and post-roll. This can be surprising as it is never seen in a CG package, but can be very helpful to see what the rig might do when you run it. These motions are not however included in the AVI capture.

CHAPTER13 - MIMIC MODE

Principle of operation:

There are times when it is desirable to have manual control over one or more axes while the rest are controlled by a computer generated curve. This need can occur in a live action shoot where the subject is not pre-programmed and manual control of some axes can allow the talent to be kept in shot. In addition it can be required for a movement so generated to be played back to produce matt passes. Mimic Mode does just this, it allows the operator to have total manual control of as many axes as he can control throughout the move, and records any movements on these axes for replay if needed. In addition, some people feel that a computer controlled move can be too smooth and prefer to have a more "organic" feel which mimic can provide.

What controls a Mimic Axis:

An axis can be controlled when it is mimicking by several different sources: 1) The hand held box, 2) A handwheel or encoder connected to the mimic board in the Root box (if there is one), 3) Grip-Sticks attached to the rig or, 4) Itself. When an axis is controlled by the hand held box, it operates exactly as normal. When it is controlled by an encoder, the motion on the encoder is used to determine the movement of the driven axis.

Types of Mimic Control:

H.H. Box: This form of mimic control allows the axis to be controlled exactly as though it were being controlled on the Hand held Box during the move, or using Grip-Sticks, and the motion will be learnt and recorded.

Encoder Pos: In this mode of control, the motion of the axis will EXACTLY duplicate the motion of the controller. Moving the controlling handwheel around and returning it to an exact position will return the axis to an exact position. This is a good mode of control if this type of response is needed. One of the drawbacks is that if you try to move the axis too fast; it will turn off, and the shot will be lost. Additionally, you can drive the axis into its end limits and in that case it will also turn off and the move will stop. The movement from the handwheel can be smoothed by using the smoothing window. This has the effect of sampling the encoder's movement over the stated range of time periods (in 1/50's of a second) and moving the controlled axis based on the average of these. This smoothes the motion, but also introduces a slight lag. Encoder pos mode also covers what is referred to as Auto Mimic (Self Mimic) where an axis is moved physically during the shot and its motion is learnt and can be played back. This works for smaller light axes and is most often done for Focus or Pan and Tilt. It would also be applicable if you were using Flair to encode the motion of a camera crane. (See axis controller for more details on Auto Mimic mode)

Encoder Pot: ensures that the mimic controller and the motor always stay in Sync. This is most applicable for axes like the focus. Typically when a move is played back, the controller and the axis are not in a matching position and have to be lined up manually before mimic learn can again be turned on. With Encoder Pot control, the system moves the controlled axis into the matching position as soon as mimic learn is turned on. In this case, the system goes into a “Mimic Goto” state briefly.

Encoder Vel: The velocity of the handwheel is used to control the motion of the controlled axis, with velocity, acceleration and limits processing. Due to this, the position of the controller does not always exactly correspond to the position of the controlled axis.

The maximum speed used here is the maximum velocity of the axis, not the maximum hand held velocity. This mode is always active when the Hand Held Box is on and is very useful for easy positioning of a pan and tilt head from a set of handwheels.

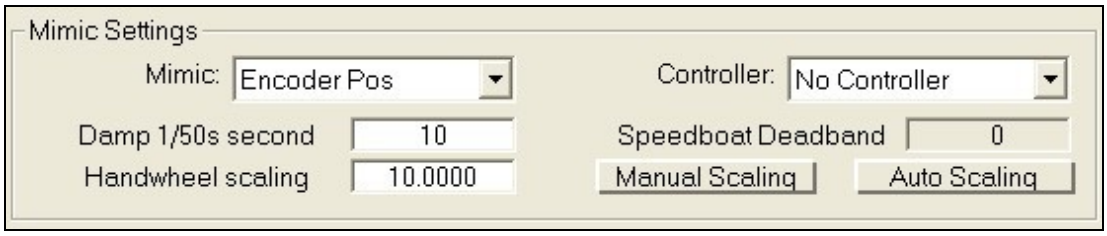
Speed Boat: A speed boat control is modelled on the speed control on a motor boat where "stop" is in the middle of travel, forwards is positive motion and backwards is negative motion. The maximum speed of the axis is determined by its maximum speed in the axis Set-ups. There is a deadband in the encoder position that relates to no axis motion, and this deadband is user settable. Whenever this mode of control is engaged, the encoder must be at the zero position as it will be re-initialised every time it is switched on.

Encoder Pos versus Encoder Vel: These 2 methods of control have various pros and cons which are good to fully understand. The advantage of Encoder Pos is that you get EXACT control between the handwheel and the controlled axis, there is no lag (as long as you do not use the smoothing window) and the position of the handwheel will match the position of the axis exactly as you use it. This can also be a problem as you can run the axis too fast and trip it out and also run it into a hard limit. Encoder Vel has processing to greatly reduce the possibility of this (though you can still do it if you really want to). However, due to this, there is a slight lag that you will notice on fast starts and stops.

One of the other drawbacks with Encoder Pos is that you have to be in Mimic Learn for it to work, and going into Mimic Learn requires that the handwheel be totally stationery. Encoder Vel is active whenever the Hand Held Box is on, and you can do pretty much what you like with the handwheels otherwise. Encoder Vel is great for positioning the axis and getting line ups and for slow mimicking. Encoder Pos is good for that precise control of the pan and tilt which is often demanded by cameramen.

Another use for Encoder Pos is for mimicking a focus axis. The advantage being that as long as you make sure that the scale on the handwheel matches the scale on the focus whenever you switch on mimic learn, then the scales will always match. The disadvantage is that it is very easy to move the handwheel too fast and trip the focus motor out in which case you have to turn off mimic learn, re-engage the axis, make sure the scales match and then switch Mimic Learn back on - not to mention the fact that if it is happens during a take, you will ruin the take. (It’s a good idea to get the focus puller used to the operation of the mimic handwheel well before you start doing takes)

For additional data on scaling and setting up Mimic controllers, see the Axis Set-up section of this manual in the Set-ups chapter.



Mimic Add:

Mimic Add is a feature that has been added to allow an existing move to be perturbed by the movement on the mimic control. One example of this would be to have a complex move on an actor, and use the pan and tilt handwheels to make only minor corrections if the actor misses his mark, but to allow the move to carry on as per normal otherwise Another possible use is to add some roughness or shake to simulate effects of motion or disturbance (e.g. helicopter, earthquake etc.). When an axis is in "Mimic Add", it will run its move as per normal, but will be displaced from this move by any movement of the controlling handwheel. Otherwise a Mimic Add axis behaves exactly like a Mimic Learn axis. Mimic Add only works with "Encoder Pos" control. You cannot Mimic Add to an axis if it is already mimicked.

Mimic Live:

There can be occasions when you wish to mimic an axis, but do not need to record the data. In this case, you can use the "Mimic Live: setting whereby you will not be prompted to warn that you are going to overwrite data, and this also speeds up job storage and retrieval. This is quite commonly used with the Focus axis where the different passes all have different focus measurements, and different layers may be de-focussed in post for optimum effect.

Setting a Mimic Controlling axis:

Setting the mimic controller axis is done simply through the pulldown list in the Axis Set-up. If you are not using an encoder for controlling the axis, then this can be set to "Not Installed", otherwise select the Mimic Axis encoder that is being used.

How to mimic an Axis:

There is a button on the Top Menu Bar labelled "Mimic", if this button is pressed, a pulldown menu appears which has an option "Axes Mimic", if this is pressed, a box comes up with a list of every axis on it along with four radio buttons for each axis. The default state of these radio buttons is "Off", the other 3 states are "On", "Live", "Add" and "Save". To set up an axis to be a mimic axis, select "On" and press the "Apply" button at the top of this dialogue box. When you return to the numeric display, that axis name will appear in red to show that it is a mimic axis and to warn you that it will not follow its plotted waypoints. Then set the "Mimic Off" toggle in the Side Control Menu Bar to "Mimic Learn". Once this has been done, the axis will be controlled by the controller that you have set up.

Learning a Move:

Enter the move that you want on any other axes in the standard way, not worrying about the stored positions of any mimic controlled axes if you are using "Mimic On". Move the mimic controlled axes to their move start positions and run the move. As the move executes, you are free to move the mimic controlled axes as you wish, and

the movements so created are stored as they occur. The move is then learnt, and at the end of the move, the waypoints on the mimicked axes are modified to reflect the mimic movement.

Replaying a Move:

Once a move has been learnt, you can replay it. The first thing to do is to turn off "Mimic Learn" or else you will destroy any recorded move, then simply run the move again. All axes will go to their start positions, and when executed, normal axes will do the usual thing while the mimic controlled axes will replay whatever motions they went through when the move was learnt. These learnt moves can be replayed as many times as wanted.

Saving a Move:

If you have recorded a mimic move, and one of the axes is to your liking, but another one needs to be re-learnt, set the correctly learnt axis to "Save" in the Mimic Set-up Display, and then its move will be saved and replayed without danger of re-recording it. In fact you could mimic every axis in this way, one at a time. A saved move can be re-learnt, simply by setting the toggle back to "On", or you can return it to a normal motion control axis by setting this toggle to "Off". When an axis has its move saved, then its name will remain red on the numeric display to remind you that it will not follow any entered waypoints.

Self Mimic:

Self mimic (also called auto-mimic) is a special case of mimicking when an axis learns the positions it is being pushed through and can then replay those. It requires that the axis be able to be back driven or moved in some independent way and it must be disabled from computer control. It can be done on some dollies where the track gearbox is not too stiff, or can be done on an pan and tilt head if you can fit handwheels over the motors. The motor obviously has to be re-enabled to play back the move. Please note that there will inevitably be some difference between the learn and the playback depending on the stiffness of your system. Only tests will indicate how much this is.

Mimic Storage:

A learnt mimic move can be stored to disk just like any other, and can be restored as needed. It does however slow down the process quite a bit as a lot of data has to be saved. The user need do nothing extra, the recording is handled automatically by the software.

Stopping a Mimic Learn:

If you stop a mimic learn while it is recording, you are given the option to shorten the length of the move down to the time at which you stopped the move. This will only work if no non-mimic axes were moving at the time you stopped the move. Normally if a move is stopped during a mimic learn, then that learn has been abandoned and will not be played back.

The normal use of this feature would be to program in the move desired on computer controlled axes and set the length of that move, and then add an extra line as a dummy hold onto the end of the move of a few seconds extra. When the move is shot, the programmed axes will execute their move and come to a stop at the end when the system goes into its hold. The mimic can be continued at this point until all the mimic

action is completed, and then the stop button can be pressed. When this occurs, a box will appear which asks you if you want to truncate the move. If you reply YES, then the move will be shortened down to the length that it was shot, and you can replay it at will. If you reply NO, then the move will not be changed, but the mimic learn will be abandoned. If any non-mimic axis was moving when you selected mimic truncate, then trying to truncate the move will produce an error.

Warning: If you are doing a lot of different takes in this fashion, please remember to reset the end frame count of the move after you have saved the move. If you do not the move will stop at the shortened point and any subsequent motion will NOT be recorded on the next take.

Recording Axes before the Move:

It sometimes happens that axes need to be recorded before the principle motion of the move is triggered. This can easily be done by entering a hold, but with unpredictable motion (Animals etc) you do not always know exactly how long to make the hold. In order to handle this eventuality, there is an advanced feature called “Mimic Learn +”. When you select this option on the Side Control Menu, and the camera is rolling with the turnover button before the move, then the axes’ motion will be recorded during the preroll and once “Shoot” is pressed, during the move. If you stop the move during its execution as in the section above, then you will be asked if you want to truncate, once this is done (or if you did not stop the move), a box will come up asking if you want to insert learnt data into the move.

If you have a good take, then you should respond “Yes” to this and after turning off mimic learn promptly save the job to disk. You will notice that the move will be modified by a point added at the start with as many frames inserted into the move as you were learning before “Shoot” was pressed. Any active triggers will have their frame count increased by this inserted value, and obviously all the move frame count will be adjusted up to suit.

With Mimic Learn +, it is even more important to change the job back to the original form after each take as many things will be changed. It is recommended that you set up a base job on disc and re-read that in order to reset the frame counts and the triggers.

This is an advanced feature and you should practice it before you use it in a shoot condition. It will also work with an external camera, but it will only work if a camera is running. On occasion, you may get the insertion dialogue box to appear at inappropriate times. If this happens, just press “Cancel” and it will disappear without changing anything.

Mimic Edit

You can edit this data in the graphics display and pull or push around the curve to achieve the exact motion you want as well as being able to smooth out any resultant bumps.

When in the graphics display you usually edit a curve by picking up and moving one or more of the waypoints. When the axis is being controlled by this "mimic" form of data, then you can pick up any part of the curve and drag it in position, up or down. The editing effect of the mouse motion is applied to the graph over a range which is

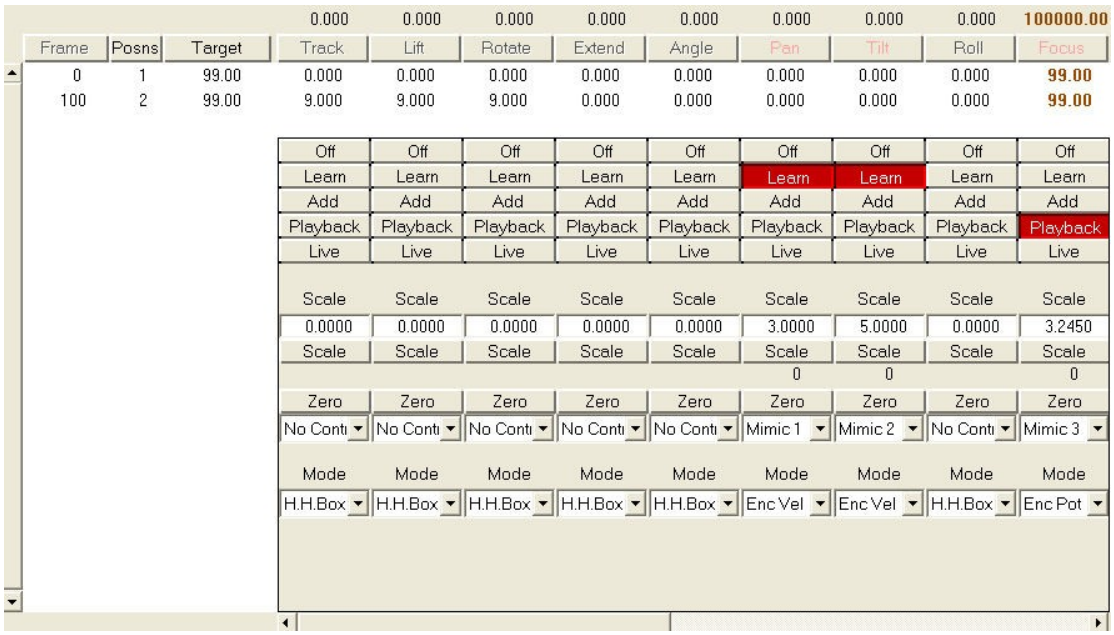
defined in frames by the "Edit Range" box at the top of the screen. The greater the edit range, the wider the effect of the editing is applied to the graph. You can edit across a large range and make a change across a large amount of the move, or a small range and pull around a few frames worth of motion. It is always a good idea to smooth the graph after you have made any changes like this to ensure a smooth junction between the modified and unmodified sections of the move.

"Start at" and "Make This" with mimic

"Start At" and "Make This" are useful features for offsetting programmed moves. They also work with Mimic moves and a mimicked axis can be offset so that the motion is the same, simply shifted as needed. A good application for this is replaying a Pan and Tilt in a different location for a background plate. If the move is correct, but not panned into the desired location, one simple offsets the pan axis to make the move execute in the right place. This does not change the move itself, simple where the move executes. Used incorrectly, of course this can change the camera motion and so lose the purpose behind replaying mimic move (You would not offset the Tilt or Zoom for example).

Show Mimic Display

A new display has been added to Version 5.0 which is designed to make setting up and running mimic moves easier and faster. When the "Show Mimic" button on the side menu bar is clicked, a display pops up that has all the required buttons and setting for configuring and running mimic moves. In this move the normal Mimic Off/Mimic Learn button is not required and is greyed out.



The top 5 buttons on the display control the state of the axis. Mostly they are off, and as such, no colour is displayed. Any axis that is another mode is show in red so they are easily discernible. Clicking a state puts the axis directly into that state with a single click. All axes can be put into the Off state by right clicking in any off button and all Learn or Add axes can be put into the Playback state by right clicking on any Playback button. (This does not work the other way around)

Below these state buttons are all the settings you might need for controlling a mimic axis, you can set the scaling , the mode and the controlling axis. These are the same as the values which you will find in each axis setup, but made accessible specifically got Mimic Control. Below the “Scale” Label is the current handwheel scaling for that axis. This number is taken straight from the axis set-up and when it is changed, the value in the axis set-up is directly changed. The “Set Scale” button pops up the same calculator that you would use in the Axis Setup when you press the “Manual Scaling” button. “Zero” allow you to zero the controller which is vital for use with “End Pot” mode. Just above the “Zero” button is a read out of the controller position which is helpful to see if you are correctly set up for mimic control.

Please note that the facility to record data before the move is not provided in this display and you will have to use the normal “MimicLearn+” mode. However, this display is very useful for rapid setting up of multiple mimic axes.

An additional difference with this mode is that when you read a job back, the axes will go into the mimic mode that they were stored with. With the other system, if you were out of Mimic Learn, then any job read in is also out of Mimic Learn regardless of how it was stored.

Mimic Smooth
Data stored in the "mimic" form can be smoothed. Smoothing is selected by choosing the "Smooth" option at the top of the graphics display. The mouse select button can be used to define the smoothing zone, the middle button will then smooth the curve every time it is clicked and will draw the new curve over the top of the old one, the right hand button is "Done" and when pressed will redraw the graph with the final smoothed curve. If you do not define a smoothing zone with the mouse select button, then pressing the middle button will smooth the entire graph. Smoothing will quickly remove sharp corners or small bumps in the move. Please note that a smoothed move and the original learnt move will not be exactly the same and will not repeat, though a smoothed move will repeat subsequently. “Super Smooth” is a smoothing mode that actually removes some of the data points and so results in a much smoother curve – however overuse will rapidly flatten a graph and it should be used responsibly. One would usually do one or two “Super Smooth” only to start with and then use the normal “Smooth” to do the rest.

Mimic Restrictions

As a general rule, you may not mimic an axis if the position of another axis is dependent on it. For example, you cannot mimic the lift axis when you are in "Keep Head Level", you also may not mimic one of the algorithmically run axes such as the focus or zoom when it is under special control. The results of doing this may work for the shot you are doing, but I cannot guarantee that it will repeat exactly between the learnt and playback moves.

If you wish to mimic the pan and tilt axes, but are not in keep head level, then the horizon will tend to tilt as you pan and tilt. In this case keep head level will work, but will tend to trip out at the start or end of the move. In order to avoid this, it is best to switch the roll into "Mimic Learn" as well and special code will ensure that it behaves as desired. You cannot at this moment mimic the horizon directly.

You can only mimic record a full forward run. You cannot do a mimic record in camera varispeed, the software will allow you, but it will not work as expected.

Focus should be in “Independent” mode when it is being mimicked and not in “Follows Object” or “Follows Target”

Target Tracking Mimic

Mimic control thus far has been applied to the control of one mechanical axis from a remote controller during a move rather than from a curve. This theory of application could of course also be applied to a theoretical axis such as the Camera Z position as well as any mechanical axis. This idea has led to the inclusion in the software of means of controlling these theoretical (or Notional) axes. The Carts Set-up section allows one to define one of various forms of input as the controlling means for a Cartesian, this may be a handwheel, a joystick or even a button on the hand held box. The theory goes that when the move is running, the user can alter the position of notional axis during the move and record what he has done for play back.

The uses of this become clearer when you consider the Milo or Cyclops motion control rig. If you are running the rig in target tracking and trying to frame up on an actor, the actor can easily slip in and out of frame by just missing his marks very slightly. The normal correction for this would be to use handwheels to drive the pan and tilt axes to keep the actor in shot. This is fine when the rig head is level or close to it, however if you are using the angle axis to get the maximum reach for the camera, then the actual motion of the pan and tilt axes does not correspond to the camera's pan and tilt orientation in the stage, and even the best operator has no chance of correcting for this as it will change as the Angle (Outer Arm) changes position.

If one could use the hand wheels to drive the notional camera Pan and Tilt (as in its orientation in the stage) then you would have a chance to keep the actor in frame without confusing the operator. In addition, a similar means could be adopted for moving the camera from side to side (Y) without having to make compensatory adjustments to the pan axis. From this you can also see why the PTR method of Target Tracking has been added to the system since driving a notional target that you cannot see with handwheels would still be very hard.

There is a high degree of complexity in this and it should be fully tested and experimented with before being used in a shoot situation. One thing to be aware of is that sudden Pans and Tilts about an offset nodal point can cause sudden accelerations in the Track and Lift and this may affect the move adversely. I have often reduced the X Nodal Offset of a lens to a low (and incorrect) value if I knew it was not important for later effects such as CGI Data integration or Scaling.

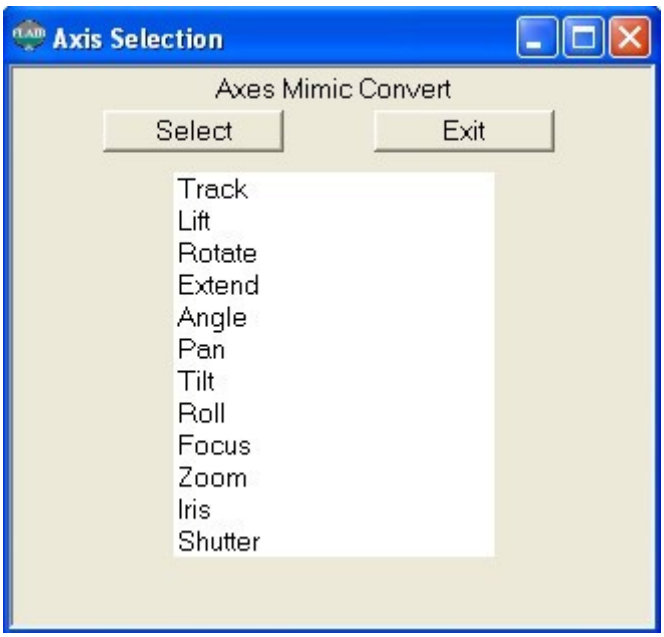
Mimic Data

In the internal workings of the system, a move is generally stored as a series of positions against time (waypoints). Whenever the computer needs to work out how to move an axis, it will calculate a curve to fit these positions, and then use the curve to work out where the axis needs to be at any given time. You don't need to know this other than to know that when you mimic record a motor's position, the positions are recorded 50 times per second and stored as a large quantity of discrete data. This is different from a normal axis move that is plotted through waypoints.

There is nothing intrinsically wrong with storing the data as a large number of discrete positions other than it is slower to save and recall the data. There is an advantage to it in that you can more easily mould the motion of the axis as there is lots of data to work with rather than a few points. The second advantage to this form of data input is that if you have to input a motion that an axis has to follow very closely (such as importing 3D data), then it is much easier to manipulate this form of "mimic" data than to have to manipulate 300 waypoints in a move.

Mimic Convert:

You can import data in this "mimic" format or you can convert a normal waypoint move into this form of data. This is done through the mimic pulldown menu selections which are titled "Axes Convert" and "3d Convert" allowing you to convert axis moves to "mimic" type moves and Cartesian moves into "mimic" type moves. Pressing either of these buttons will provide the user with a list of the available axes to convert. One simply selects which axes you want to convert with the mouse so that they appear highlighted, and then press the "Convert" key. Axes that are successfully converted are switched into the "Mimic Save" mode. Any errors will produce a message, the most usual reason would be that the axis is disabled and therefore has no move calculated for it.



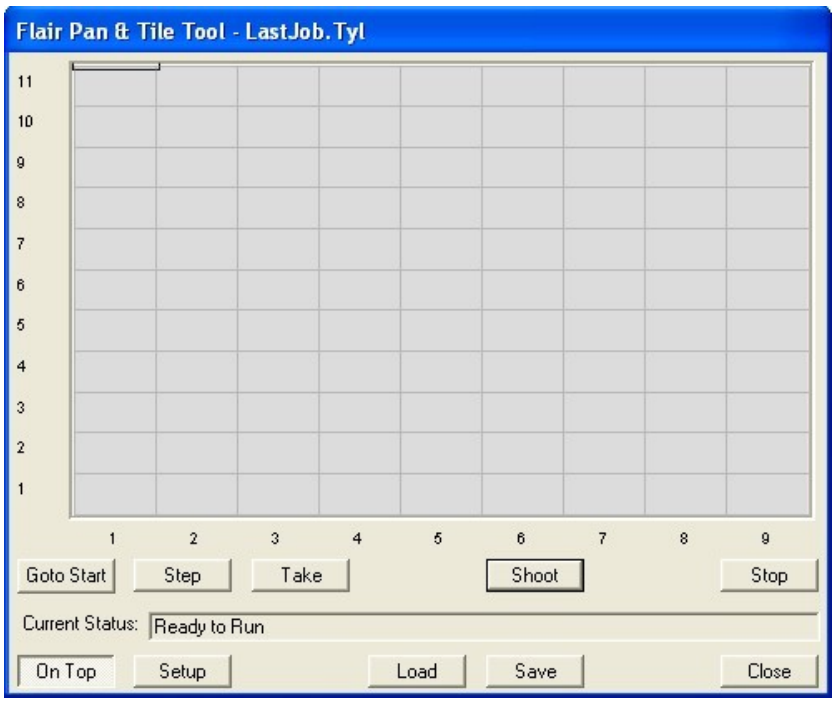
You can convert any mechanical axis motion that is planned through waypoints, you cannot convert a target tracking axis when the system is in target tracking, and you cannot convert an algorithmic axis such as focus, or zoom.

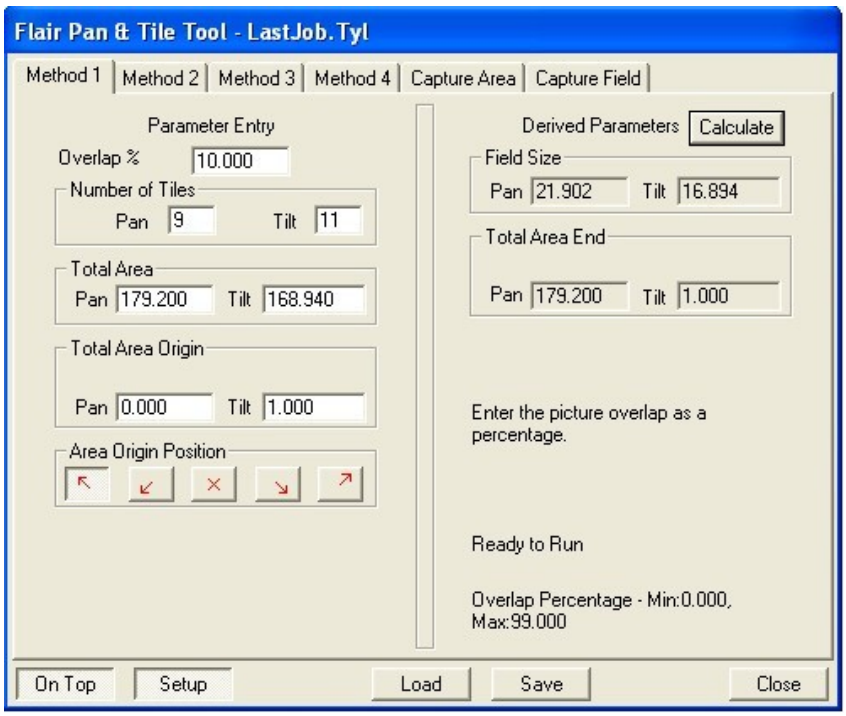
Once an axis has been converted, to change it back into a normal motion axis, switch its mimic state into "Mimic Off". Once an axis has been converted into this form of mimic data, you cannot add waypoints to the start or end of the move, the mimic data will be expanded or squeezed to run from the start of the move to the end. You can edit this data in the graphics display and pull or push around the curve to achieve the exact motion you want as well as being able to smooth out any resultant bumps.

CHAPTER 14 - SPECIAL EFFECTS

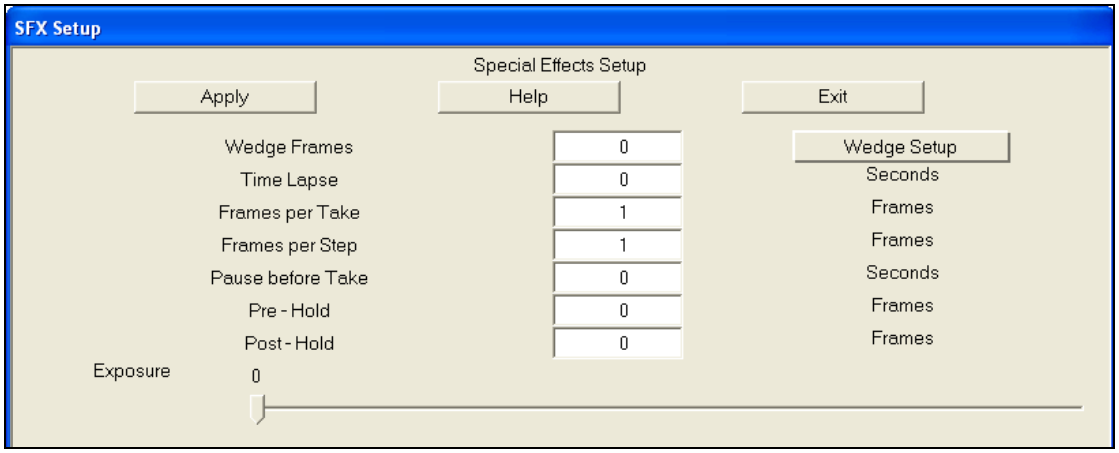
The Special Effects set-up allows the user to alter settings that mostly apply to stop-motion special effects normally used in traditional single frame motion control, but also includes scaling.

Pan and Tile: Also called the Tyler or a Tesselator, this feature can be used to shoot large panoramas or backgrounds by shooting small sections which are then "stitched" together in post. The software allows for different methods of specifying the total area, number of tiles and the amount of overlap between the tiles.





Film Effects



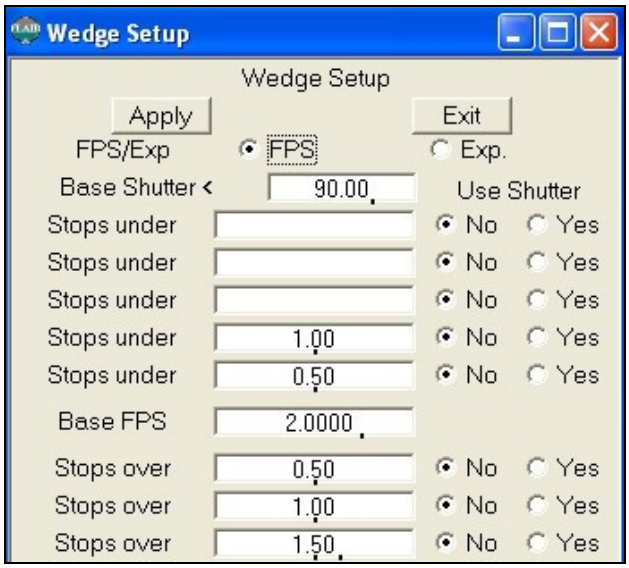
Wedge Frames:

The wedge frames is the number of frames that will be shot at each single frame position, and the exposure on these frames can be altered to allow the user to shoot a selection of exposures for testing or other purposes. These exposures are set through the "Wedge Setup" display. If one is not shooting a wedge, this would normally be set to 0.

Wedge Setup:

Using the wedge setup, you can specify the normal exposure at each frames and up to 4 over exposures and 4 under exposures which are defined as a number of stops, fractional if desired. A blank setting or a setting of 0.0 if ignored. Each row has the option if using the shutter to assist with the exposure compensation if the system has a shutter and it can be opened or closed to achieve the desired exposure. If you are using the shutter, you also have to specify the shutter angle at the base FPS.

The camera speed is usually shown in Frames Per Second, but it can also be displayed in exposure time as decimal seconds. EG 4.00 fps with a 180 degree shutter is 0.125 seconds as a frame takes 0.25 of a second, half of which is the exposure phase.



Stepping Effects

Frames Per Take:

This value sets the number of frames that are taken with every step of the move when you single step through the move. It is the number of frames actually exposed every time a step button is pressed.

Frames Per Step:

Very similar to Frames Per Take, but this value is the number of frames of the move that you advance through with every step. When Stop Motion stepping, the number of frames exposed with each step is controlled by the Frames Per Take value. When you are taking Moving Steps, the number of frames exposed is affected by this value. This value also affects how much you step through the move when you click the mouse in the move slider bar.

Pause Before Take:

When stepping through a move with a portable rig that is not as stiff as a studio rig, it is sometimes necessary to let the rig settle down after each step to allow any shake to dissipate. This is not a problem when you are manually stepping through the move, but when you are continuous stepping, this can be a problem. This value introduces a delay between steps when you are continuous stepping either in Stop Motion or Moving Step. The value entered is the number of seconds of delay between each step.

Time Lapse:

Similar to Step Delay except that each step is shot at a specific time after the move is started. Where step delay is relative to the last step, Time Lapse steps occur relative to the start of the move and are therefore more accurate. Will only work where you are running in Continuous Step mode, either Stop Motion or Moving Step. If you stop the rig while it is running a Time Lapse Shoot, the move will lose its continuity.

Exposure Position:

This affects the position of the exposure relative to the position at each frame. Consider a simple move lasting one frame – it has a start position and an end position. When this is shot, the exposure will occur with a slight blur from when the camera shutter opens (about 1/4 into the move) until it closes (about 3/4 through the move). In effect you are recording the centre position between the first position and the second position. When you are doing stop motion, you can vary where in this region the exposure will occur using the Exposure Position slider. For example if this slider is set to 0.5, then the exposure will take place in the middle of the frame, where the exposure would normally occur if you were shooting continuously (but without any motion blur). When you are running with Frames Per Step higher than 1, this value applies to the relative position within the whole step however many frames it is.

Pre and Post Holds

With Pre and Post holds, you can define a hold at the end or the start of a move without having to plot extra points into the move. This has several advantages in that the hold is not part of the move, and does not have to be programmed, and it is also not scaled up and down as you adjust the length of the move to your liking. In addition, it is only executed when you actually shoot the move, so there are no unnecessary delays when you are running the move in dummy. Note that when you run the move backwards the posthold length is shot first, and the prehold length at the

end. These holds do not work when recording onto a video system, or shooting with an external camera.

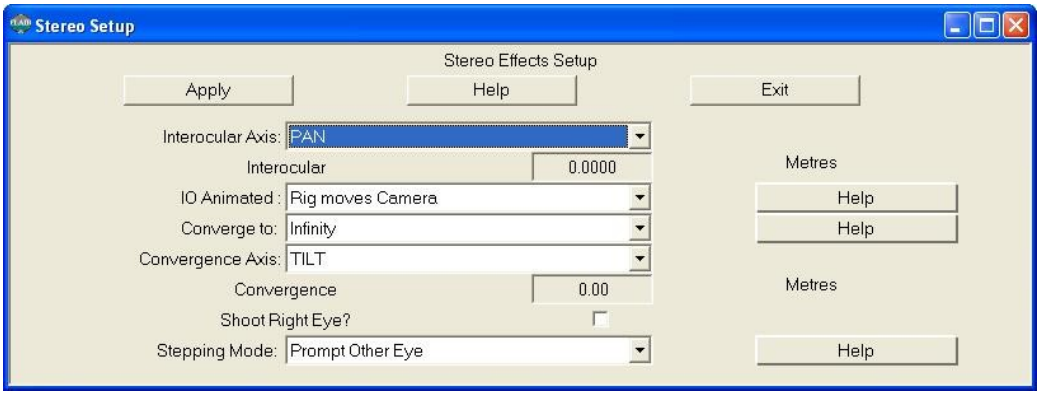
Pre-hold

You can enter the number of frames you want the camera to take before the move starts. For example if you enter 50 in this box, then whenever you record a move with a forward run, then the camera will ramp up to speed, then take 50 frames, and then the move will start. The preroll at the start of the move will then be at least as long as the prehold you have stated.

Post-hold

You can enter the number of frames that the camera will run after the move is shot. As above with Prehold. If you start the camera before the move by pressing the Turnover button when you are at "Ready to Shoot" and later trigger the move, if there is a posthold, that will be executed at the end of the move and the camera will then stop. If you do not want the camera to automatically stop in this case, set the posthold to 0.

Stereoscopic setup. (Optional)



One of the additional special effects you can create with Flair is shooting a left and right eye pass for stereoscopic shooting. Live action, of course, requires a stereoscopic camera, but animation and model shooting can be shot with one camera doing single frames of left and right eye or shooting the left eye and then the right eye. Mostly with puppet animation you would shoot single frames of each eye as you go along; model can be shot either way. With normal scale or miniatures, the interocular distance is often so small that you could not easily mount 2 cameras side by side, so moving the camera a little side to side for each frame can easily achieve the desired effect.

The stereoscopic setup allows you to define the interocular distance and also the convergence mode of the move as well as how you want to shoot the passes.

Interocular: Defines the interocular distance in metres.

Converge to: Is a pull down menu with a list of options. Infinity, Convergence Target, Focus Distance. Converging to infinity means that the camera will simply move side to side with no convergence (toe in). You can set the desired convergence distance and the camera will converge on that and you can also have the camera converge onto the entered target tracking target or the entered focus distance.

Convergence: Allows you to set the desired convergence point if that mode is used. (Again in Metres)

Right Eye: This flag is used to determine is you are shooting the left eye or the right eye. By default the left eye is deemed to be the master and the right eye is the one that is offset from the programmed target tracking move. If the flag is left unchecked, then the left eye is shot for any pass. If you check the flag and an interocular distance is set, the right eye pass will be shot. This is valid for shooting one eye and then the other.

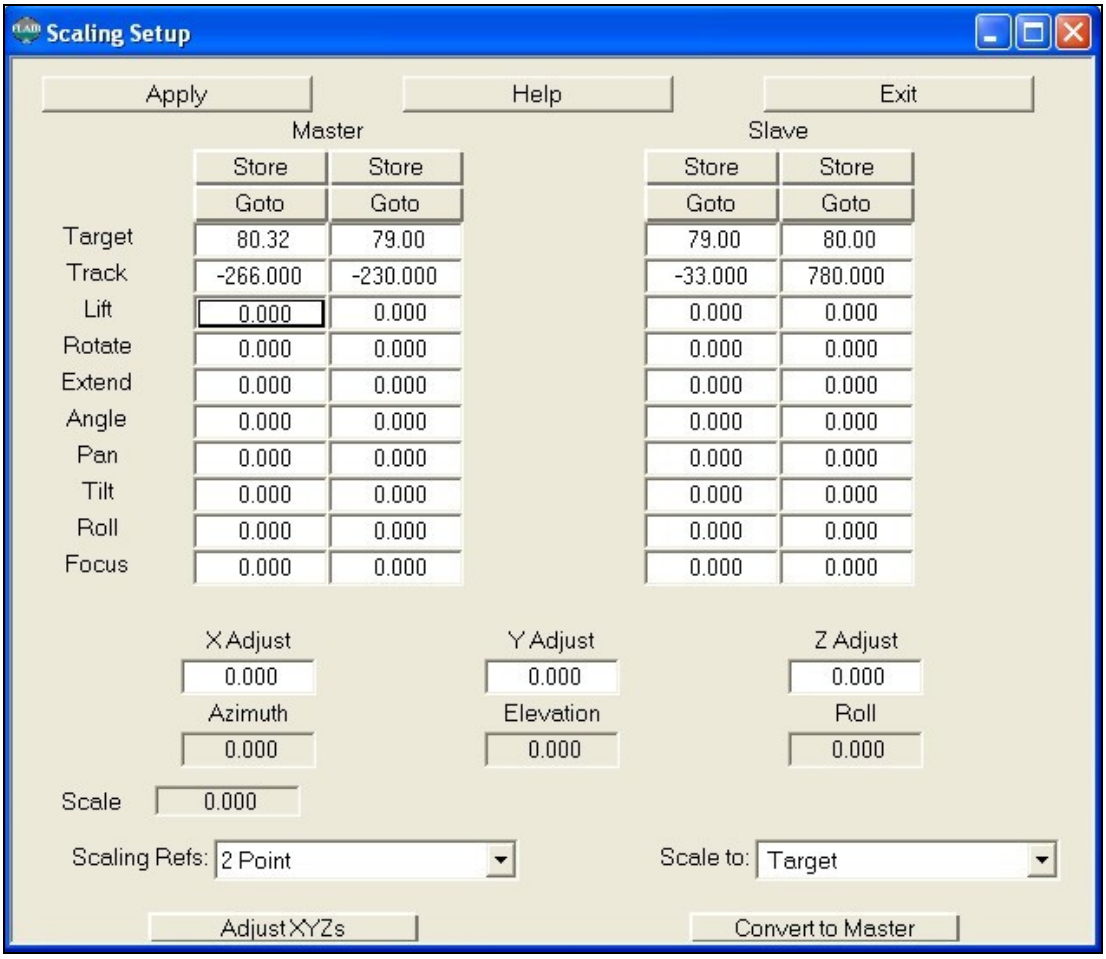
Stepping Mode: is valid when you single step through a move and want to shoot the left eye then the right eye. The modes are "None", "Prompt Other Eye" and "Auto Take Other Eye" These are pretty self explanatory, and allow you to set the machine to prompt before it take the other eye or simply automatically do it. It would be a good idea to have checked the entire move for both eyes in a non-record mode before you did this single stepping. The rig will automatically go to the alternate eye position for each frame.

Scaling

Scaling is a sophisticated addition to the target tracking facility. It allows the user to take an existing target tracking move and scale it, up or down, to match between a model and the real item, or any 2 objects so that the move path is exactly the same shape, but moved and scaled, from the master move on the master item onto the slave item. The move that is entered normally is referred to as the Master Move and the scaled or adjusted move is the Slave Move.

How it is defined:

There are 2 ways of defining the scaling for a slave move. Both methods require reference points on the master item and on the slave item to tell where they are in space. 1 point scaling only requires one point on each, and the user manually enters the scaling factor to tell the computer how much to scale the move up or down. In 2 point scaling there are 2 corresponding points on the Master and Slave items which serve to inform the computer of the relative sizes and positions of the master and slave items. Once these are defined, then the actual 3D Master move path is moved and scaled from the master item onto the slave item. For example you could have a full size person standing near the rig, and have a move that starts looking at his feet and lifts up and around to look at his right ear. If the user enters into the system reference points on the full size person and then enters the exact same reference items on the model, the move can be executed on the model so that the actual shape and relationship of the move is identical.



Entering and Running a Scaling move:

Scaling is a sophisticated feature of the program and requires considerable understanding from the user to gain the most from it. The first thing to do is to work out in your head what the desired moves are, and see if this will work in both the master and slave cases. If the master move is on a doll and finishes with the camera 2 feet above the head of the model, then the slave move on a full size man will finish with the camera about 12 feet above the head of the man (assuming 1:6 size ratio). The points all have to be thought about before the move is actually entered. In addition it is usually better to enter the larger move as the master move, and make the slave move the smaller, though this is not always possible, it has the advantage that errors are scaled down, not scaled up!

Once the move has been planned, the master and slave items must be positioned so that the move can be shot on both items without the rotate axis turning past 90 degrees on either move (see ‘scaling limitations’). Once this is done, plot the master move on the master item in the normal way entering it as a target tracking move. When the master move is worked out roughly, it is a good idea to try out the slave move to ensure that it will do it before you spend hours getting the master move exactly right, and then find out it won’t work!

The first thing to do is to go into “Scaling” which is found under the SFX button on the Top Menu Bar. When this is selected, you will be presented with a box with 4 columns in it, 2 columns for the master reference points, and 2 columns for the slave reference points. Near the bottom of the screen is a box labelled "Scale" which tells

you what the calculated scaling factor is. There is also a toggle “Scaling Refs” next to it which switches between "1 point", "2 point" and “Line Up”. When you switch this, the second column of reference points on the Master and Slave items are enabled in “2 point” scaling and disabled in “1 point” and “Line Up” scaling.

1 Point Scaling: This has the advantage that you only have to reference one point on the Master item and one on the Slave and you can manually set the scaling factor. It does not work well where the Master and Slave items are not parallel to each other, but in most cases, you would want to set them up that way. This method is easier to use in practice and should be used as a first method. The reference point that you plot is entered by pointing the rig at the chosen point, storing its positions into the column of figures on the scaling display and entering the target distance to that point in the "Target" entry box. It is the point that you are measuring to that matters, where you look at it from is relatively unimportant, but if it can be from somewhere in the move path (more or less) that is a good idea. The point on the slave item must of course be a corresponding point.

Line Up Scaling: This is an extended version of 1 Point Scaling which has been developed with the assistance and input of Jerry Nilson of Denmark. The principle is similar to 1 point scaling in that you set the size, but the orientation of the camera between the master and slave points determines the difference in orientation of the master and slave moves. This method does NOT account for tilt mismatches, and only works for rotations about the vertical axis. Tilt mismatches are ignored, but may be added with a later version. The concept is that if you grab a freeze frame on the master and store that point, then line up on the slave and store that point, it should set all the offsets etc. that you need.

2 Point Scaling: This method works well where you do not know the scale between the items or they are not located in exactly the same orientation in space. You are basically using the rig to survey the Master and Slave items so that the system knows where they are, what orientation they are and what their size relationship is. Accuracy is very important in 2 point scaling, and care must be taken. You also have to be careful that Master Item reference point 1 corresponds to Slave item reference point 1 and that Master item point 2 corresponds to Slave item point 2. As with 1 point scaling, it is not really important where the rig is, it's the point that you are looking at that is important, however putting the rig somewhere near the move path is a good idea.

You have to log the first reference point on the Master item into the first column, and enter the distance to the reference point. Then move the rig to look at the second reference point. Then enter the positions of the axes into the second reference point column, and type in the distance to the reference point in its relevant column. Now move the camera to look at the point on the slave item that corresponds to the first reference point on the master item, and enter this point as the first slave reference point. In the same way, enter the second slave reference point.

Reference points on an item must not be directly one above the other. The sideways motion of the reference points indicates the direction from which the object is to be viewed, and if you enter totally vertical reference points, then the direction of view is indeterminate and you can get very odd results, the move will be correct, but from the

wrong angle. Note that with 2 reference points, you are only defining a line, and not a plane, so that the object must be in the same orientation in relation to the lines between the reference points. If you had reference points on a man's head and his toes, and also a child's head and toes, the moves would be scaled properly, but the direction from which the person was to be viewed would be indeterminate.

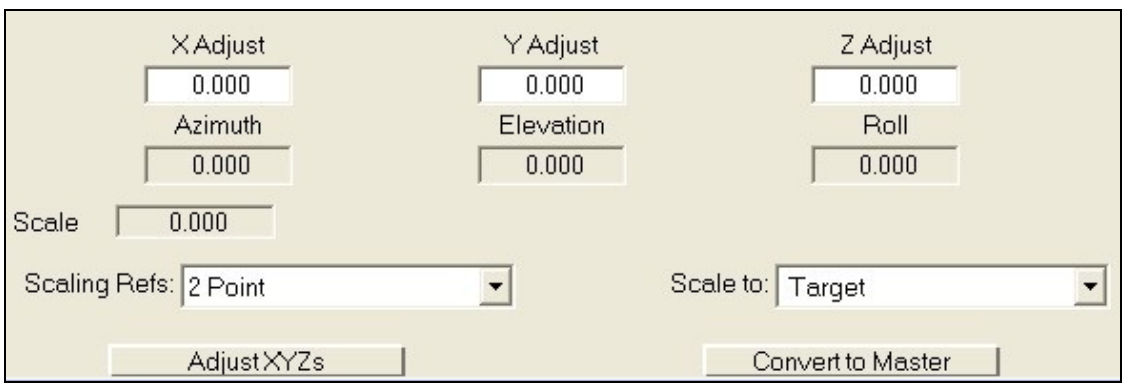
Once the reference points are all entered, they can be checked by using the “Goto” button which will cause the rig to go to the entered reference point in each case. With all the reference points entered correctly, Apply the scaling Set-up. In the Side Menu Control Menu Click on "Master Move" and it will change to "Slave Move". Now press “Fwd Run” and see if the system will allow you to run the job. If there are no errors, and you get “Ready to Goto”, then go ahead and run the move. If however there is an error, it could be caused by several things, and the answer is to go into the “Scaling Effects” box again, and check the reference points. At this time, the actual size ratio between the master and slave move will have been calculated, and will be displayed in next to the label "Scale", and that may assist you in finding the fault. The most likely cause of a major error is a badly entered reference point or points. It could simply be that the move is too fast and it only needs a few more frames, or it could be that the reference points have been entered backwards on the slave as compared to the master move, and the camera wants to dig itself 6 feet under in order to get the shot!

The most common cause of a poorly matched scaling move is a badly entered reference point or a badly set up rig. If the reference points are not entered accurately, the scaling move can be badly affected. If the move is more or less right, but not up to the required standard, enter each reference point again, taking extreme care to measure the target distances accurately, a few millimetres can make an appreciable difference especially when up close.

When you are in "Scaling move: Slave" the 3D graphs will display the slave moves for both the target and the camera. This can be useful in trying to isolate any mismatch between the master and slave moves.

X,Y & Z Adjust

The Slave move can be moved around in 3D space by using the X,Y&Z adjust buttons. Any entry into these boxes will move the slave move around by the distance entered in Metres. If you attempt to edit a scaled move in the 3D Graphics display, any movements made with the mouse will not edit one specific waypoint, but will be applied to these XY&Z offsets and will affect the entire move.



Azimuth, Elevation and Roll

These rotational angles are only available in "1 point" and "Line Up" scaling modes. They are 3 rotational angles that can be used to rotate the slave move around in 3D space. They are not for the faint of heart and are for seasoned professionals only; don't try this at home. Consult MRMC if you have a specific need in this regard. The Azimuth is basically a rotation of the slave move about the vertical axis based on the 0,0,0 origin (normally this would be a vertical line through the turret of the rig when it is at zero. This can be used to rotate the move to the left or right, or even 180 degrees around. The Elevation is a rotation about the horizontal side to side axis (Y) which would be similar to a tilt but this occurs after the azimuth rotation and the axis of elevation is not affected by the azimuth rotation. If you pan and then tilt the camera, the tilt axis has moved with the pan, however, the elevation rotation is not affected like this. It gets even more complex with the Roll rotation which is like a roll with the camera at zero. There are several caveats with doing this, not the least of which is the limitation in scaling of going outside of a quadrant on a rotational axis (see below), and also if you use the Elevation or Roll rotations, then the horizon will not match from one move to the other.

Scale To

Scale To is a feature that allows the user to define the point about which you are scaling as the camera point or the target point. When a move is only scaled up or down, one point will stay in the same place, and everything else moves about that point. This toggle allows you to state whether it is the camera that you are scaling about, or the target.

Since you have no target in PTR Target Tracking, then one should scale about the camera. Also if you are shooting a background plate and have no target to scale about, you can also use this method of scaling when you are in normal Target Tracking.

Adjust XYZs

This button is for setting the XY&Z adjust fields such that the current camera position is the same as the Slave Move start Camera position. It simply determines where the camera should be for the current frame, where it is now and sets the XYZ fields to the difference. The main use of this would be for shooting a background plate for the slave move where you are not actually trying to line up 2 items to one another. Please note that the current frame is best set by doing a "Goto" to the frame at which you want to do the adjustment.

Initing axes in scaling:

When you run a scaled move, the default initialisation point for any rotational axes is 0.0. This means that if you have a move where the rotate is greater than 90degrees, the scaled version of it will be run with the rotate set to a value that is less than 90 degrees, with the other axes moved to maintain the same camera position. This may or may not be the right solution in many cases, and you do have the option to initialize the scaled move to start at the solution closest to the entered waypoints from the move. In this case set the "Init Scaling" flag in "Miscellaneous Setups" to "Yes"

Convert to Master

When you are running a slave move, the positions listed in the waypoints are the positions for the master move. With this button, you can clear out the master move,

and enter the slave move as its own move with a waypoint for each position. You can then adjust the slave move around with the normal move editing features. Please note that when you do this, you will be editing a move and it will no longer match to the master. Please save the master move to disk before converting the slave as you will lose the master move. Note that when you do this, you will be running reverse kinematics on the Slave Cartesian Positions. The Section above on Reverse Kinematics also applies. A Slave move that has been converted to a Master may not exactly match the original Scaled Master. This is because the new positions may be in a different orientation and the curve fit may not be exactly the same.

Note on Cartesian Priority

When you are scaling moves up or down, the motion of the master axes may have to be different between the master and the slave move. However if you simply change the master axes positions, then you will alter the master move and thus you will not get a match between the 2 moves. The handling for this is to select Cart Priority in the Job Type display once you have calculated or run the master move and then you are free to adjust the master axis positions without changing the Cartesians which will still be scaled as expected. Please be sure to save the job before and after you make changes so that no work is lost. Read the section above on Reverse Kinematics for more data on this and you must verify that the rig is properly set-up.

Tip, Warnings and Limitations:

The entering and running of scaling moves is one of the more complex parts of the program, and it does require a good understanding not only of the system, but also of exactly what you are trying to achieve. Get the move worked out in your head in terms of a 3D path, and then imagine what the resultant path will look like on the slave item and see that this move is in fact achievable. Once you have a good idea of roughly what the slave path will look like, and where it will be, then you have a much better chance of getting it right. Don't forget that not only is the move scaled up, but the distance to the target is also scaled up (or down).

No system is exactly perfect, and the accuracy of any target tracking or scaling move depends on the accuracy of the Set-up of the physical parameters of the rig, and also the accuracy with which the distances are measured, and points lined up. Whilst target tracking itself is reasonably forgiving, and will not show up minor errors; scaling is very unreasonable, and will tend to show up any inaccuracies in the axes scaling or zeros. In addition, if you are scaling up a move, then the inaccuracies will be scaled up too.

The normal target tracking limitations as listed above also apply to scaling, but with a couple of additional items. You cannot turn the rotate through more than 90 degrees from straight ahead during a scaling master or slave move, the rotate has to stay between +90 degrees and -90 degrees throughout the move (or it has to stay between +90 and + 270 or -90 and -270) . You cannot put multiple turns on the pan or tilt axis, they have to stay between + and - 180 degrees. If you do need to use a rotate angle that is greater than 90 degrees, then you can set the Init Scaling toggle in the Miscellaneous Set-ups to “Yes”. Setting this flag can also help in similar situation with the Pan and Tilt. See “Init Scaling” for an explanation of what this does.

If you find that the slave move puts the camera in more or less the right place, but points it in exactly the wrong direction, then this may be fixable through the various

settings of the “Pan Handling” toggle in the Miscellaneous Set-ups display. This is also helpful when importing CGI moves.

Snorkels:

When you are in target tracking, you can use a snorkel lens in Keep Head Level and it will work as intended. This however will severely reduce your range of motion and this may not be what is needed. You will find that using target tracking out of Keep Head Level will produce better results than if you are not in Target Tracking, but it will not necessarily target track and the XYZ output data will not necessarily match the movement of the lens. A snorkel does require a Z offset in order for the computer to determine which way it is looking. Due to this, you must enter a Z offset for any snorkel lens no matter how small. You may find that if you enter 0.0 it will come back as 0.001.

Moving the “Up” axis:

If your scaled move is rolled such that the horizon plane is not parallel to the master horizon plane, then the roll axis will not work properly between the Master and Slave moves unless the master move was programmed and shot in “Roll Up” mode.

The best way to gain experience and skill with the scaling feature of the Flair program is to use it and practice on simple moves until you really understand what is happening when you shoot a scaling move, then try more and more complex moves. As you go along, try making intentional errors in your input, and see what the result is so that if it happens on a set, you are more likely to know how to handle it. Experience has shown with scaling that if it is going badly wrong, then it is usually a major Set-up error, or an entry error. If it is going a bit wrong, but is generally right, then it is more likely a minor Set-up error such as a zero, or the rails aren’t straight etc. (more likely on portable rigs)

Also to be noted is that if you drag the move slider bar to a frame count, or do a "Goto Frame", the rig will go to a specific frame of the slave move when you are in "Slave Move" mode. However "Goto Position" will still send the rig to the listed position in the Master move.

Additional Scaling Options:

The pull down menu in the control menu has several options listed under the standard two: “Master Move“ & “Slave Move”. These options are : "Reflected Move ", **"Adjusted Move ", "Adjusted Targ", “Inverted Move”, "Move Miniature", "Slave & Min.", "Scale Zoom"**

These options are for advanced users only and will be covered in an addendum distributed to interested users, but briefly:

Reflected Move: The 2 Master and Slave reference points designate points on a VERTICAL mirror in which the move is to be reflected. The master points locate the mirror for the Object (Master) move and the slave points locate the mirror from the Image(Slave) points. This is to handle the likely occurrence of the rails being moved from one shot to the next.

Adjusted Move: In this case, the Target Tracking move is run with the designated Miniature Auxiliary axes being used to adjust the motion of the Camera and Target. The axes designated as XV, YV, ZV (in the kinematics setup) are used to input

motion in Metres that will be added to the camera and target move. If you are in PTR Target Tracking, the Pan, Tilt and Roll axes are unaffected.

Adjusted Targ: In this mode, the XV, YV, ZV additions move the Camera as expected, and the XT, YT, ZT axes are used to input motion in Metres to add to the target move if in normal Target Tracking or are used to input additional motion in degrees that is to be added to the Pan, Tilt and Roll respectively when in PTR Target Tracking.

Inverted Move: Allows the user to define an inversion plane by the height of the camera in the slave column and the Master move is inverted about this plane. This is really the same as a reflected move with a horizontal reflection plane, but is simpler. The roll can be expected to behave correctly using this mode, its motion will be negated.

Move Miniature: This setting is for working with a real time "hanging miniature" where the miniature is in the foreground and has to follow a scaled down version of the camera move to make it appear like it is not moving in respect to the background. The reference points here are used to define the location of the miniature and also where the corresponding place that the miniature is supposed to appear. One would normally program the larger Master move on the camera and define the scale of the miniature to the camera (> 1.0 if the miniature is less than full size!), and then the Min Aux axes will move the model as needed to match the camera motion, the pan and tilt of the camera is irrelevant and you have to have set up the nodal point of the lens accurately.

Slave & Miniature: A slightly more complicated version of the above, except that the Master move programmed is on the miniature, and the Slave move is for the Camera AND the Min Aux axes.

In both of these latter cases, you can add an Additional motion to the miniature by putting a move into the Min Aux axes and selecting the option "Move Miniature:" to "Yes" in the miscellaneous setups. This will result in a motion on the miniature in addition to that required to make it appear to stay in one place.

Scale Zoom: Is a secret feature only to be used by the brave and foolhardy ☺ It is unlikely to show up on your menu except by prior arrangement.

CHAPTER 15 - VARIABLE CAMERA SPEED

Introduction:

Some specialised camera effects can be achieved by changing the speed of the camera during the move. The facility has been implemented into the Flair software in a flexible manner which allows the user to put this effect to full use.

2 Modes:

There are 2 basically different modes of variable camera speed. In one form, the speed of the camera can be made to change during the move without the speed of the move changing as it is shot. This means that a move that takes 14 seconds to shoot will still take 14 seconds to shoot, but when the exposed film is replayed, it will have a different length depending on the changes in camera speed. In this mode, passes shot with different ramps will NOT match. The other mode is to have the speed of the move change with the camera. In this mode, the speed of the shoot will be affected, but the exact same number of frames will have been exposed, so the exposed film will be of the same length and exactly match as if it had been shot at constant speed.

Speed Change and Exposure Compensation:

As the speed of the camera rises and falls, the exposure has to be compensated for. This can be done by dimming or raising the lights, opening or closing the iris or by opening and closing the shutter (if the camera has one). The triggering of external lights can be done through the output triggers, and the frame counts on those will match the frame counts in the camera speed programming graph, so these can easily be aligned. (In this case colour compensation may be a problem, but that is outside of the scope of this manual). Iris compensation and shutter compensation can be achieved through use of the program's automatic compensation feature.

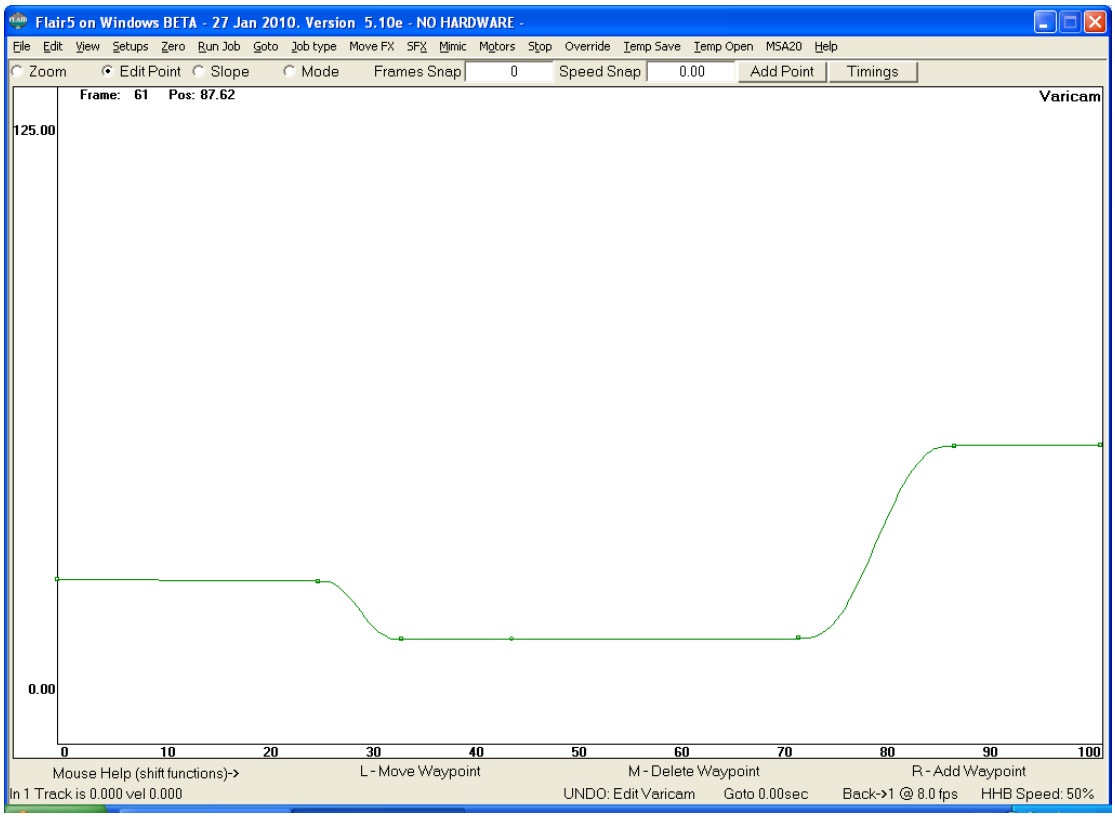
When variable camera speed is selected in the "Job Type" display, the user is given several different choices which are briefly described here:

" is fixed "	No camera speed change.
" varies "	Camera speed changes with the move - no exposure compensation is performed.
" shutter comp."	Camera speed changes with the move, the shutter can be used to compensate for exposure changes
" iris comp."	Camera speed changes with the move and the iris can be used to compensate for exposure changes
" shtr+iris comp."	Camera speed changes with the move and the iris and shutter each compensate for 1/2 of the exposure change.
" varies w/o move"	Camera speed changes during the move but the move is otherwise not affected.
" shtr comp w/o move"	As above but the shutter compensation
" iris comp w/o move"	As above but the iris compensation
" shtr+iris comp w/o move"	As above but with the iris and shutter each making 1/2 of the required compensation
" Move varies w/o Camera"	Move varies but the camera speed does not vary

When one of these (apart from "is fixed") has been selected, one is then able to go into the camera speed editing graph and implement the changes he desires.

Camera Speed Editing Graph

The speed of the camera is programmed through editing a graph of speed against frame count. Before the camera speed is edited, the move should be fully worked out and checked at the fastest speed of the camera to make sure that the move can be executed. Then set the camera speed to the speed at which you want the move to start and enter the Camera Speed Editing graph.


Flair5 on Windows BETA - 27 Jan 2010. Version 5.10e - NO HARDWARE -
File Edit View Setups Zero Run Job Goto Job type Move FX SFX Mimic Motors Stop Override Temp Save Temp Open MSA20 Help
Zoom Edit Point Slope Mode Frames Snap 0 Speed Snap 0.00 Add Point Timings
Frame: 61 Pos: 87.62
Varicam
125.00
0.00
0 10 20 30 40 50 60 70 80 90 100
Mouse Help (shift functions)->
L - Move Waypoint
M - Delete Waypoint
R - Add Waypoint
In 1 Track is 0.000 vel 0.000
UNDO: Edit Varicam
Goto 0.00sec
Back->1 @ 8.0 fps
HHB Speed: 50%

The screen displays frame counts along the horizontal axis and camera speed up the vertical axis. The slowest speed is 0 and the highest speed depends on the highest camera speed your camera can run as set up in the "Camera Axis Set-up" display. (setting this lower can make editing the camera speed graph easier). The camera speed itself is represented by a series of dots indicating camera speed waypoints, and circles indicating beginning of ramps, these are joined by a blue line showing the camera speed at any instant. The points on the graph depict the frame count at which the camera will have completed its speed change, this allows the user to simply position a point at a frame and speed, and know that the camera will be at that speed by that frame count - ramps are applied backwards from the camera speed points.

The Control Buttons at the top of the screen provide the following features:

Zoom:

The left hand mouse button allows the user to zoom into one area of the graph to provide more accurate editing/display of that section. Double clicking the mouse

button will revert back to the full size display. The other mouse buttons are non functional in this display.

Edit Point:

In this mode, all the mouse buttons are functional and provide full editing control. The left hand button allows the user to click on a waypoint and move it, the middle button will delete the nearest waypoint (not first or last) and the right hand button allows the user to set a waypoint at the current position of the mouse. The waypoints can be edited in time and speed except for the first and last waypoints which have a fixed time.

Slope:

This function changes the ramp which the camera uses to change speed. Generally these ramps are set by the maximum acceleration of the camera. Ramps can be lengthened by using the left hand button to move the ramp point (blue circle) further to the left. If a slope is edited to be quicker than the camera's maximum acceleration, then it will drop back to that maximum rather than adopt the new incorrect ramp. The middle mouse button allows you to reset the slope at any given camera speed point back to the default which is the current maximum camera acceleration (Not yet implemented). The right hand button will reset the graph to a constant speed at the currently set camera speed, deleting all entered points.

Frames Snap & Speed Snap:

With a long move, it can be difficult to set the camera speed point at the exact position required. The "Snap" facility has been added to make this easier. This is modelled on layout programs that cause the positioned point to "snap" onto the nearest set unit of distance.

The speed and frames snap are used in exactly the same way: you either type in the exact speed and position you want and edit or add the point; or you can enter the nearest round number to snap to (e.g. 10 Frames or 5 FPS), and then when added or edited, the point will only be at exact multiples of the entered values. These boxes can also be blanked out with the backspace delete key, and this will disable editing of that axis. (The result is undetermined when adding a point). When editing with the snap facility enabled, the point cursor will move around only to legal positions, thus clearly showing where the edited point will be.

Add Point:

This button will cause a waypoint to be added at the current setting in the Frames and Speed snap boxes. It is simply an alternative way of setting the waypoints exactly where you want them.

Timings:

This button produces a report on the intended move as currently programmed, stating the different frame counts at which speeds are achieved, the time taken in real seconds to get to that point, and the speed that is attained. This can be used to plan and trigger events to coincide as desired.

Resetting the Path:

You can reset the camera speed path back to the default which is a constant speed at the current camera speed. Select the "Slope" option on the editing buttons and click the right hand mouse button on top of the graph. Please note that the camera MUST be in forwards (fwd) not reverse when you do this or the graph will be off screen!.

Notes:

1) Velocity checking of the move is adjusted to compensate for change in camera speed and acceleration; however moves should be checked in as much as possible at the highest intended camera speed to eliminate standard over speeds caused by moving too fast. Errors then produced will mostly be due to changing the camera speed too quickly.

2) If you make the camera change speed too quickly, it will attempt to execute the change you have programmed. This will most often be caused by putting 2 points of different speed too close together in time. In many cases you will get away with it as the camera can often change speed faster than you would think. However it is up to you to ensure that no damage is done to the camera on extreme speed changes.

3) Very slow camera speeds (e.g. 0) will not work if the move changes speed with the camera as the slower the move goes, the slower the camera changes speed, and everything will basically grind to a halt. Very slow speeds are OK with the move not compensating with the camera if you like that sort of thing!

Programming the Compensation:

Exposure will be adjusted based on the initial programmed camera speed and the initial entered position of the compensation axis on the first line of the move. That is to say that if the camera starts at 25 FPS, and the first line of the move has a shutter position of 90 degrees; then if the camera slows by 1 stop, the shutter will open to 180 degrees; and if it speeds up by 1 stop, then the shutter will close to 45 degrees. All other programmed positions of the compensating axis are totally ignored.

If the user plots a stop change that cannot be compensated for (e.g. 200 degrees of shutter or F stop of 0.2), then the move will be rejected in the same fashion as a standard move if it exceeds the limits of travel of an axis. Also if the axis has to move faster than its programmed maximum speed or acceleration to effect a speed change, then a similar error will be reported. In this case, the ramp of the camera could be extended, or the change in speed could be reduced.

Of course it is also totally possible to do the exposure compensation manually, but then the user will have to enter all positions for the compensating axis, including holds during constant speed sections of the move.

Shutter Compensation:

When shutter compensation is selected, the computer will attempt to adjust the position of the shutter so as to keep the exposure on the film the same. In order for this to work, the system has to have an axis driving the shutter itself, and that axis has to be correctly scaled so that the axis read out is in degrees of shutter, with 0 being closed and 180 (or 170 etc.) being fully open. The relevant axis must also be selected as shutter type in the axis Set-up box (see Chapter 4 for more details).

Iris Compensation:

As with shutter compensation, the computer in this mode will attempt to move the Iris to compensate for the stop gains or losses. There must be an axis driving the iris itself, and it must be selected as "Iris" in the axis Set-up box (see Chapter 4, Axis Set-ups, for more details). Additionally, the iris must be correctly linearised. With an iris ring, motor motion does not translate directly into F (or T) stops and thus the relationship between these has to be defined to the system in order for this to work. The exact procedure for setting this up is covered in Chapter 4 "Lens Set-ups".

Once correctly set up, the iris must also be selected as operating in "F Stops" by selecting that option in the "Job Type" Display. After that the procedure is as covered above.

Shutter & Iris Compensation

Sometimes too large a compensation is required to be achieved by just the iris or just the shutter; also the change in motion blur or change in depth of field can detract from the shot. In both of these cases, the compensation can be split between the iris and the shutter so that a greater range can be achieved, or the same range, but with lessened change in depth of field or motion blur.

Running the move

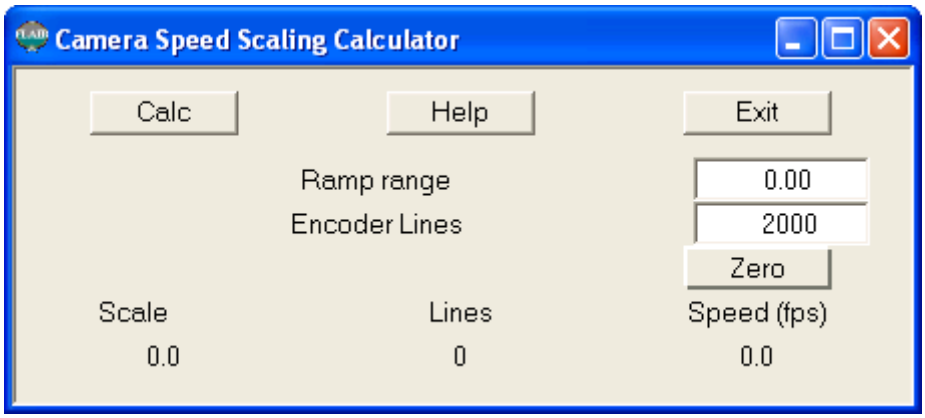
Once the move has been entered and the variable camera speed has been profiled, you can run the move as per normal. The speed checking will check the move, but it is recommended to try them out at a lower rate if you have a particularly fast move. In order to facilitate this, when you are in Variable Camera Speed mode, the FPS box on the run control bar becomes semi-inoperative, and if you click on the "Move FPS" label, it will change to "Move %" and the box below will be the % speed that you are running the move. I.E. you can try the move out at 50% and it will only get up to 1/2 of its normal full speed. You may incidentally try it out at up to 200%. If you click this back to "FPS", the percentage automatically reverts to 100%. At the slower speeds, the iris and shutter compensation is non functional, this feature is for testing the move only.

Pre-holds and Post-holds

The feature that allows you to put pre-holds and post-holds on the move is operational with variable camera speed as is the feature that allows you to start the camera before the move. However you may not stop the camera during a vary speed move, nor start it.

Mimicking Variable Camera Speed

This is a mode in which you can control the camera speed as a mimic axis. The control is similar to the positional control of an axis, except you are changing a speed not a position with the controller. The scaling of the mimic controller is set up using the Camera Speed Scaling Calculator:



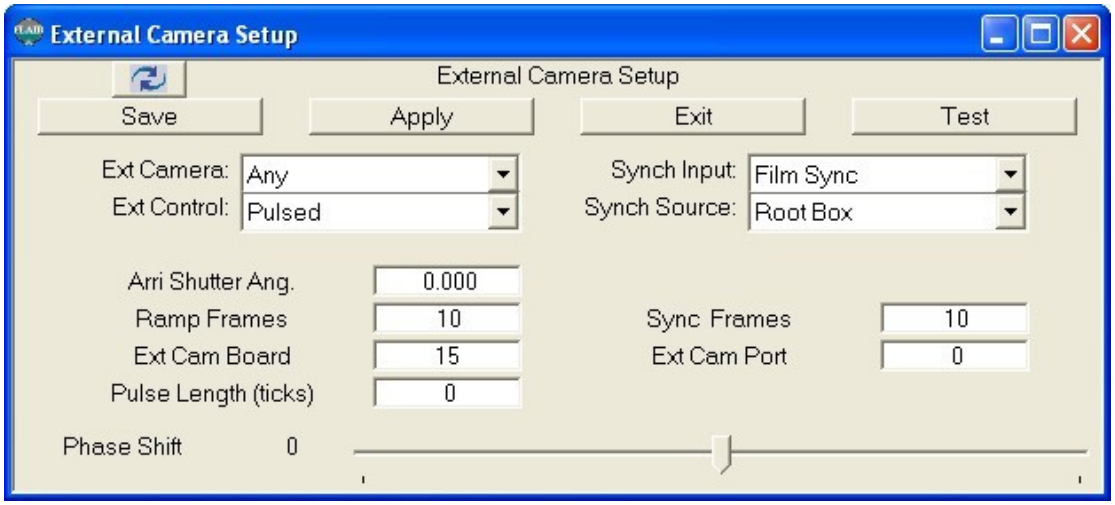
The Ramp range is the amount of speed change you want from one end of the controller's motion to the other. It is generally a good idea to make this as small as possible so that the camera speed change is as smooth as you can make it. High changes in camera speed will cause the rig to trip out and the shot to be lost. Once you have set the number of encoder lines and the desired range, pressing the “Calc” button will work out the scaling and then the display at the bottom with show you the change in camera speed as you move the controller.

The zero position of the controller is very important as every time you switch Mimic Learn on, the controller will be zeroed out and changes from its zero location will increase or decrease the camera speed and also affect the shutter and/or iris. Like a normal mimic axis, you can learn and replay speed changes if they are working as desired. Speed change cannot currently be smoothed or otherwise adjusted

CHAPTER 16 - SYNCHRONISATION

Introduction:

The basic concept involved in synchronisation is to get the system to run at the same speed as an external camera so that moves can be matched even though the recording source is not fully under the control of the system. This includes video cameras as their recording rate is not under the computer's control. The Set-up that allows you to control this interface is under the "External Camera Set-up".



Lost Synch

In earlier versions of the software, a synchronised move would stop whenever the system detected that the camera was out of phase with the move by more than a certain level, or if it was running at a speed significantly different from that of the move. Given that most modern cameras are crystal locked and the Flair system is crystal locked, the most common reason for the appearance of this could be noise on the cable connecting the camera to the Flair system. It was decided therefore that if the synch is lost, the move will continue along, but a warning box will be put onto the screen to let you know that synch has been dropped. It is then up to the user to decide whether or not to cut the shot depending on the circumstances.

Connections:

There needs to be some electrical connection into the root box consisting of either a standard video signal being plugged into a BNC in the case of video, or some wiring into the input triggers in the case of a film camera. The technical data on the triggers should explain how to make the correct connections, if there are any problems, contact MRMC for assistance. You may also synchronise to a signal coming in to an Ulti-Head. In this case, the Sync Source is switched to be the board number of the Ulti-Head not counting any mimic boards/ MSA20s. For the standard Modula Rig, this would be Board 2 where Board 1 is running the Track, Lift and Rotate.

Phase Shift:

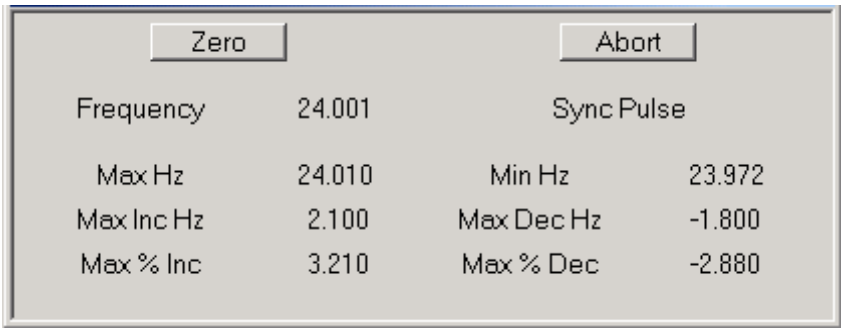
While the computer is maintaining the same speed as the incoming pulse, it also maintains the same relative time relationship to it. It's like having 2 cars driving down the motorway, if they are driving at the same speed, then the distance between them will not change. The phase shift is how far apart they are, and with this software, it can be adjusted to have one car 1/2 length up on the other, or 1/2 length behind. The practical upshot of this is no matter where in the frame the sync pulse comes, you can adjust your system to synchronise correctly to it. Also if you are shooting a TV screen, you can adjust the synchronisation phasing until the sync bars are out of the safe area. (Given that the camera has sufficient shutter angle to be able to expose a whole field).

Stability:

Synchronisation will work with almost any speed up to 150 FPS as long as the incoming pulse is stable. If the incoming pulse varies by +- 5% then the sync will not be stable, and it is possible that the move will become rough as the computer tries to keep pace with an erratic incoming pulse.

Testing the incoming frequency:

If you want to check the incoming sync pulse as to when it is actually arriving, and also at what frequency, there is a status box in the External Camera Set-up display. Simply pop up this display by selecting it from the Set-ups menu bar, select the "Test" button on this display and a new box will pop up showing the current incoming frequency in the Source Frequency box, and the label to the right of this will say "Sync Pulse" if pulses are coming in and “No Sync Pulse” otherwise. In order to assist with determining what may have caused or be causing timing problems with synchronisation, there are boxes which inform the user of the maximum detected frequency and the minimum detected frequency as well as the deviation in cycles per second and percentage. These values can be reset through use of the "Zero" button and you can see if there is significant variation in the detection of the synchronisation pulses. A percentage deviation of 5% would cause the system to drop synch.



Running an external Camera:

This option is labelled "Ext. Camera" and has 2 options "None" and "Any". When "Any" is selected, then the system will attempt to run an external camera whenever a move is run. The main difference when this switch is on is that the system will not complain if you are in record but the internal camera is switched off. If the internal camera is on, it will also be run, but the external camera is assumed to be the more important. Also note that when this option is selected and the “Turnover” button is pressed, the system will run the external camera in preference to the internal camera.

External Control:

One of the trigger outputs on the root unit is dedicated to running an external camera, and also you can specify an output trigger on one of the axis boards to run an external camera. The trigger can either be pulsed to start and stop the camera (”Pulsed”) or can be held continuously high during the time the camera is supposed to run (“Cont High”) Most cameras operate with the “Cont High” mode. In the “Pulsed” mode you can also specify how long the pulse is. Normally a single tick (1/50) of a second is enough, but some systems such as video camcorders do not detect this and need a longer pulse. Consult the camera documentation or MRMC if you have any questions. The axis board output trigger is selected through the “Board” and “Port” entries in this display, this is not normally wired to any specific output and you should contact MRMC for any assistance.

How to synchronise:

In order to sync the system to an external source, you have to select a sync option. The sync pull down has several selections: “None”, “VTR Sync” and “Film Sync” (In special cases additional options may appear). The most usual selection would be “Film Sync” in this case, the system will attempt to synchronise the move to an incoming pulse on either the Video Input or the Film Input. Whenever a move is run in “Record” mode, (I.E. the button on the Control Bar says "Record" on a film system or "VTR On" on a Video system). The speed of the move MUST be set to the speed of the incoming sync pulse. If your move is set to shoot at 25.0 FPS, and the incoming frequency is at 12.5 FPS, the move will stop very rapidly. “VTR Sync” is a special mode used when you are controlling a PAL VTR that locks the system timing to the incoming video signal. This is vital for accurate single frame recordings.

Before the move starts:

When you press the button to shoot the move, the first thing that happens is that the system waits for a few frames to allow the camera to get up to speed. This is set up in the External Camera Set-up display by the box "Ramp Frames". If your camera starts slowly and needs some time to get up to speed, then this value can be changed to allow that to happen. With a video system this value can be set to 0, and the step will be missed out. After the ramp frames is completed, the system will start locking sync with the incoming pulses for as many frames as you have set up in the "Sync Frames" value, this is really just a buffer, and need only be a couple of frames. During this time the Status Bar will display "Locking Sync".

Preroll:

If any pre-roll is required on the move, then this will occur immediately after the sync frames, and the axes will be moved back and then into the move with the computer keeping sync to the incoming source.

During the Move:

As the move runs, the computer will detect every incoming pulse, and maintain the internal speed of the system to match that incoming pulse. Even if the pulse changes speed slightly throughout the move, the system will keep track with it, and will maintain the same relative phase shift to the pulse. This means that moves shot using this feature should be able to be matched frame for frame.

Synchronisation loss:

If the timings between the system and the incoming pulse vary by too much, an error will be reported. There are 2 possible errors: either the frequency of the incoming pulse has varied too much in which case the system will report that synchronisation has been lost, or if the phase relationship between the system and the incoming pulse varies by more than 1/4 frame, then the system will state that Phase Lock has been lost. If this happens, then it is likely that the frequency of the sync pulse is not stable, and the computer is having trouble locking in to it. It is also possible for the sync pulse to stop completely, in this case, the computer will wait a reasonable time for it, and then will post an applicable message.

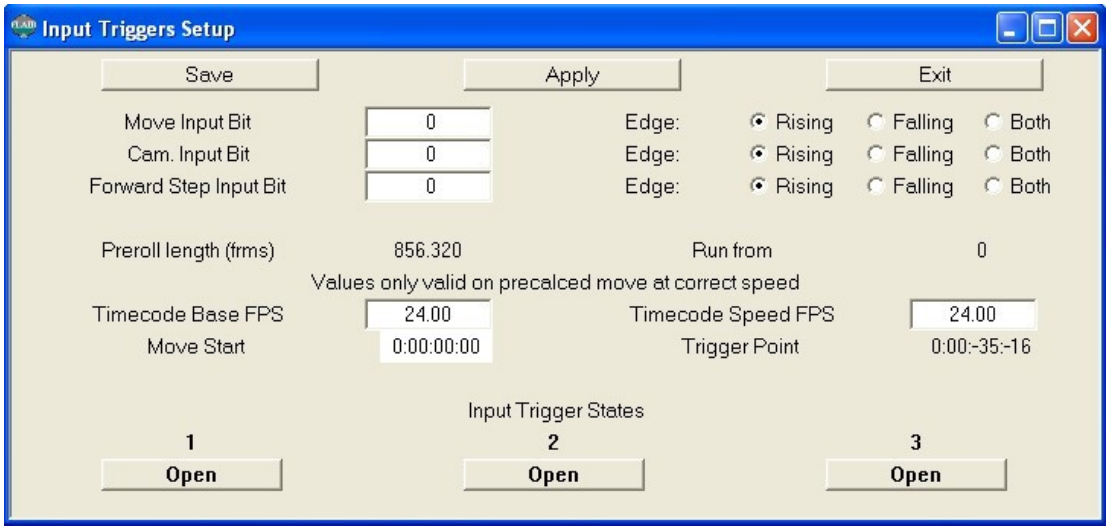
Adjusting Phase Shift:

If you need to adjust the Phase Shift between the move and the external source, then you can do this as the move is running. The simple way is to put in a long hold, and shoot that. While it is running, adjust the Phase Shift slider in the External Camera Set-up display until the correct phase shift is achieved, and then use that phase shift value for your moves. When shooting a video screen, you can either look through the gate and get the bars out of frame, or if you have a revolving mirror, look through the viewfinder and get the sync bars in frame. Once found, a phase shift value should not need to be changed, but it is always a good idea to double check before you start exposing any film. Please note that the sync lock does not work when you are using the "Turnover" feature, you have to actually be shooting a move. Please note that you can often see sync bars on a video assist screen which have to do with the phase relationship between the video you are shooting and your video assist - so don't use a video assist when setting this up.

CHAPTER 17 - INPUTS AND OUTPUTS

Inputs

There are 3 separate inputs that can be used to trigger the start of the move, the camera to start running or the move to step forwards 1 step. These can be wired up to lighting desks or to time code readers or simply to a push button if you wish to trigger one of these events from a separate source. When the button is activated, the action will start in the next 20 milliseconds, so an accurate move start is accomplishable.



Move, Cam. & Step Input Bits

You can select an input to be active by setting it up in the Inputs Set-up Display. Enter the number of the input into the relevant box, and then when the function is valid, if that input is activated, then the function will be triggered. There is a row of boxes across the bottom of the Input Set-up display which correspond to the 3 inputs, and you can test and identify your inputs by watching these boxes as they change state with the inputs. If you do not wish any of the inputs to be active, then set the Input Number to 0.

Move Input Bit: If a valid edge is detected on this input, when the system is at Ready to Shoot, then the move will be started.

Cam. Input bit: A valid input here will cause the camera to start rolling when you are at "Ready to Shoot" and the camera is engaged and not in Dummy. If you want to use this trigger to start the camera, you must check that the take ups have been tensioned, the camera is engaged, not buckled and not in dummy.

Step Input Bit: Used to trigger the system to take a step forwards along the move path. This will only work when the system is at "Ready to Shoot" or "Ready to Step".

Edge

A voltage level can rise, fall or pulse. Each input can be set to obey only a rising edge, only a falling edge or both. The button at the bottom of the screen tells you which

input is in which state. “Open” indicates a low state and “Closed” indicates a high state.

Please note that the inputs to the root box have logic in them to ignore switch bounces, and this can make the system miss a state change if it is preceded or followed by switch bounce. Please use de-bounce circuitry for any mechanical switches or relays.

Preroll Length

If your move requires there to be a preroll before the move actually starts, then this will occur after the input has been activated, and the actual move will not start immediately. In this case, once the move has been calculated and is ready to shoot, get the system out of a run state by pressing the mouse stop button and go into the Input Set-up Display. There is a field that displays the amount of required pre-roll in frames, and this can be used to set up the correct triggering. Most moves however have very little or no preroll. If the move starts from rest the only axis that prerolls is the camera, this is usually quite short but is displayed as above if needed. This preroll is calculated in the system as a number of 1/50's of a second, but it is displayed in frames at the currently set camera speed. Therefore this number may not be a whole number of frames.

Run From

This is also an output field and reminds you of the frame count at which you are starting the move.

Timecode Calculations

A Timecode calculator has been added to the inputs Set-up to allow you to calculate the correct timecode point to trigger a move. When you are recording something that has to match to a timecode (such as a music video), then several laborious calculations have to be done to make sure everything matches. If for example you do one pass starting at the beginning of the move at time code 00:01:00:00 then if you part run the move from frame 347, you have to convert 347 frames into a timecode, subtract the rig preroll times in frames from that time code and then add it to the start timecode, working in base 25 and base 60 unless of course you are shooting at 30 fps which needs different calculations.!!

Timecode Base FPS & Timecode Speed FPS

Timecode is a stream of numbers representing frames, seconds, minutes and hours. There are at least 4 different formats for this, each one having a different number of frames in a second. The most common are 24, 25, 29.97 and 30. It is important to fully understand this when you are dealing with timecode as often the other people you are working with do not understand it, and you could be misled (e.g. in the U.S. timecode for songs is almost always 30 FPS, but is sometimes referred to as 24 since the camera runs at that speed !). The Timecode Base FPS is the number of frames that make up a second and is normally one of the above speeds. The Timecode Speed FPS is the speed at which that timecode is being played back. If you make a normal 30 FPS timecode, and play it back twice as fast, it is still a 30FPS base timecode, but it is running at 60. These numbers are vital in correctly figuring out the correct trigger point for the move.

Move Start:

The user enters the timecode at which the move should start into the "Move Start" timecode box. Once this has been done, whenever the move is calculated at the correct speed, the computer will do the calculations for you and the timecode at which the rig should start its preroll will be displayed in the "Trigger Point" timecode box.. Even starting at the beginning of the move, the rig needs some time, if only to get the camera up to speed. Above on the display, the computer also tells you the intended start frame of the move you are shooting (usually 0, but can be later for part runs)

This data is only valid when you have given the computer all the data about the move. If you later change a camera speed, or switch the camera into or out of record, then the data it gives you will not be accurate and you have to calculate the move and go back into this display to get the now correct data. (Calculating the move would involve telling the computer to run it with a forward run or part run or using the “Check Move” button, and allowing it to present you with "Ready to Goto" or "Ready to Shoot") If you leave this box on screen while you change things, the data will not be updated, you have to call up this box after all the prerequisite steps have been taken.

If you are starting the camera before the move by using the "Turnover" button, then the rig will not need the camera preroll time when you trigger it. In this case you should process the move with the camera in "Dummy" to get the correct trigger point, and then switch it into "Record". This is more complex, and I would not recommend it unless you have pressing reasons for doing so. It is also prone to be slightly less accurate in terms of matching the move to the timecode exactly. It could be up to 1 frame out of sync at normal timecode speeds.

If you are doing ANY form of complex timecode work with off speeds or other variations, you should always have some form of backup check to make sure that the move is working in sync with the sound as you expect as an error here can be hard to detect and impossible to correct afterwards. The calculator here is quite complex, and any slight mis-setting will cause a poor result, and the presence of the calculator does not absolve the operator of his responsibility to make sure that the shoot goes correctly.

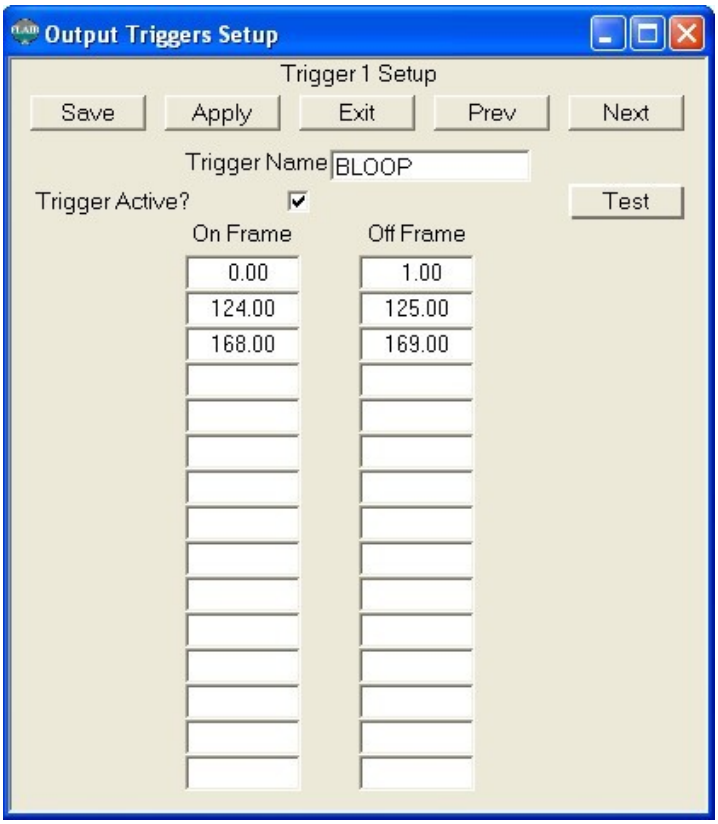
Trigger Point

This is the calculated value of the timecode at which you should trigger the move to ensure that frame 0 will line up with the timecode entered into the Move Start box.

Outputs:

Introduction:

The user has control over 10 output triggers. These can be controlled to change state during the move at exactly repeatable times. For each Output (called a trigger), the user can change the name of the trigger, whether the trigger is active or not, and at what frame counts the trigger goes on and off. There are 2 columns provided with 15 entries in each. The user can switch any trigger on and off up to 15 times within the move. The frame count (fractional if desired) at which the trigger is to turn on is entered in the left hand column and the frame count at which the trigger is to turn off is entered in the right hand column. The move can be shot forwards or backwards, or part run. Moving Step will work, but Stop Motion will not operate the triggers.



There is an additional way to use the triggers to produce a repeating series. Program in the repeating series you want as an on and off time, leave the next on time blank, but program into the off time at what frame count you want the series to repeat. A series of numbers: on 1.0, off 2.0 followed by a blank on, and then 3.0 in the off column would cause a trigger to turn on and off for one out of every three frames. This is called a Cyclic Trigger.

The “Insert” and “Delete” keys can be used in the triggers display to insert or delete line entries, and the subsequent entries will be shuffled up or down to suit.

Triggers may be caused to occur before the actual move by programming in a negative frame count for the trigger. When the shoot button is pressed, the system will go into a preroll state and the trigger will fire at the appropriate time before the move. When a move is run backwards, the triggers before the start will occur after the system has run back to the beginning. These triggers outside of the move will cause preroll and postroll conditions for the system, when no axis is moving and this may not be desirable whilst testing a move. In this case turn triggers off (or that relevant trigger off) and this will be remedied. If you get strange long prerolls and postrolls on a normal move, it could be that you have some trigger from a previous move that has not been switched off.

This feature’s performance is undetermined when synchronising to an external camera, or when starting the camera before the move. Please note that when you are synchronising with an external camera, the timings of the system are changed to mesh in with the camera, and due to this, a trigger starting at frame 0.0 MAY be missed. In order to avoid this, you should not program any triggers that start or stop within the first few frames of a move.

You cannot combine Cyclic Triggers with Triggers before the move. Cyclic triggers only work within the actual move time, not within the prerolls or postrolls. Also note that Cyclic triggers are processor intensive and therefore it is inadvisable to enable too many Cyclic Triggers at once, as the processor may run out of time to do all the required move calculations.

Name: The name of the trigger can be changed. The triggers are normally simply labelled Trigger 1, Trigger 2 etc., but if you have a trigger wired up for a specific purpose you can change its name e.g. call it "Flash Gun" or "Tape Start" etc.

On/Off: This controls whether the trigger is active or not. When set to off, the output trigger will not activate during the move.

Test: Can be used to turn the trigger on and off manually. When depressed the trigger should activate and deactivate upon release.

Frame Counts: There are 2 columns provided with 15 entries in each. The user can switch any trigger on and off up to 15 times within the move. The frame count (fractional if desired) at which the trigger is to turn on is entered in the left hand column and the frame count at which the trigger is to turn off is entered in the right hand column. The move can be shot forwards or backwards, or part run, and the triggers will operate at the expected time. Moving step will also work, but stop motion will not operate the triggers. In order to blank out fields, select the box in the standard way and press the backspace delete key.

You can set up a trigger to fire before the start of the move by entering a negative frame count. If a trigger is set to fire before the move, then the pre-roll for the move will be extended to at least as long as the earliest trigger. The length of this preroll will be displayed in the Input Set-up once the move has been calculated (see above). This can be used to provide a consistent preroll for a move regardless of whether the camera is on or off.

Cyclic Triggers:
Any trigger can be set to repeat in a cycle throughout the move. Enter the first On and Off Frames, defining the duration of the trigger. Leave the next On Frame blank, and enter trigger repeat frame into the next Off Frame box. For example to enter a trigger that flashed during exposure time, set the first On Frame to .25, the first Off Frame to .75, and set the second Off Frame to 1.0. For a trigger that flashes once every 10 frames, enter 0 and 1.0 in the first line, and enter 10 into the second Off Frame as the trigger cycle length. These triggers work forwards and backwards, but do not work outside of the normal move. i.e. during preroll or postroll. Please note that cyclic triggers do involve considerable processing, and if many are used with a Target Tracking move, it is possible that the system will run out of time to do the move calculations. If this happens, reduce the number of cyclic triggers you are using. It is unlikely that this will occur.

Triggers On/Off

There is a switch which allows you to turn all the output triggers on or off. This button is on the side "Control Menu" and toggles between "Trigs On" and "Trigs Off" and refers only to the output triggers. This feature has been added so that physical effects which you may want to fire at specific frames do not keep turning on and off when you are rehearsing the move. The default state is "On".

Trigger Number 1

The first trigger on the system is dedicated to operating an external camera if your system is set up for one. If the option "External Camera Set-up" appears on your Set-up menu, then the first trigger is assigned to start and stop the external camera. If you are synching to an external camera, then this trigger will operate to start the camera. The system will wait for the camera to get up to speed (See External Camera Set-up for more data) and then the move will be shot. This trigger will stop at the end of the move, and that should stop the external camera. More data on this trigger is available in the section on External Camera Set-up in Chapter 4.

Unlike other triggers, this trigger is operational when you are stepping. If you have set the system up to have an external camera and it is active, then you cannot really sync to it if you are single stepping in stop motion. However, this trigger will go active for a frame every time you step. This can be used to trigger an external frame store device etc. If you are stepping more than one frame per step, the trigger will go on for a longer time. Also note that if you do have the internal (camera as an axis) camera running at the same time, this trigger will activate AFTER the internal camera has taken a frame.

With an RT10, this trigger is propagated down the axis pipe to any Ulti-Board, and will cause the external camera trigger on the Ulti-Board to fire at the same time.

Wiring:

Each of the outputs works as an independent switch closure, with both sides of the switch being presented to the user, this means that the computer can be totally isolated from the thing that is being triggered, and wiring errors will not affect the computer adversely (though they can in extreme cases damage that output). Contact Mark Roberts Motion Control if you require any assistance, if you have specifically stated that you are going to use the outputs, a technical data sheet will have been supplied to you.

Please refer to Appendix A at the end of this manual for related pin-out information.

CHAPTER 18 - DATA EXPORT & IMPORT

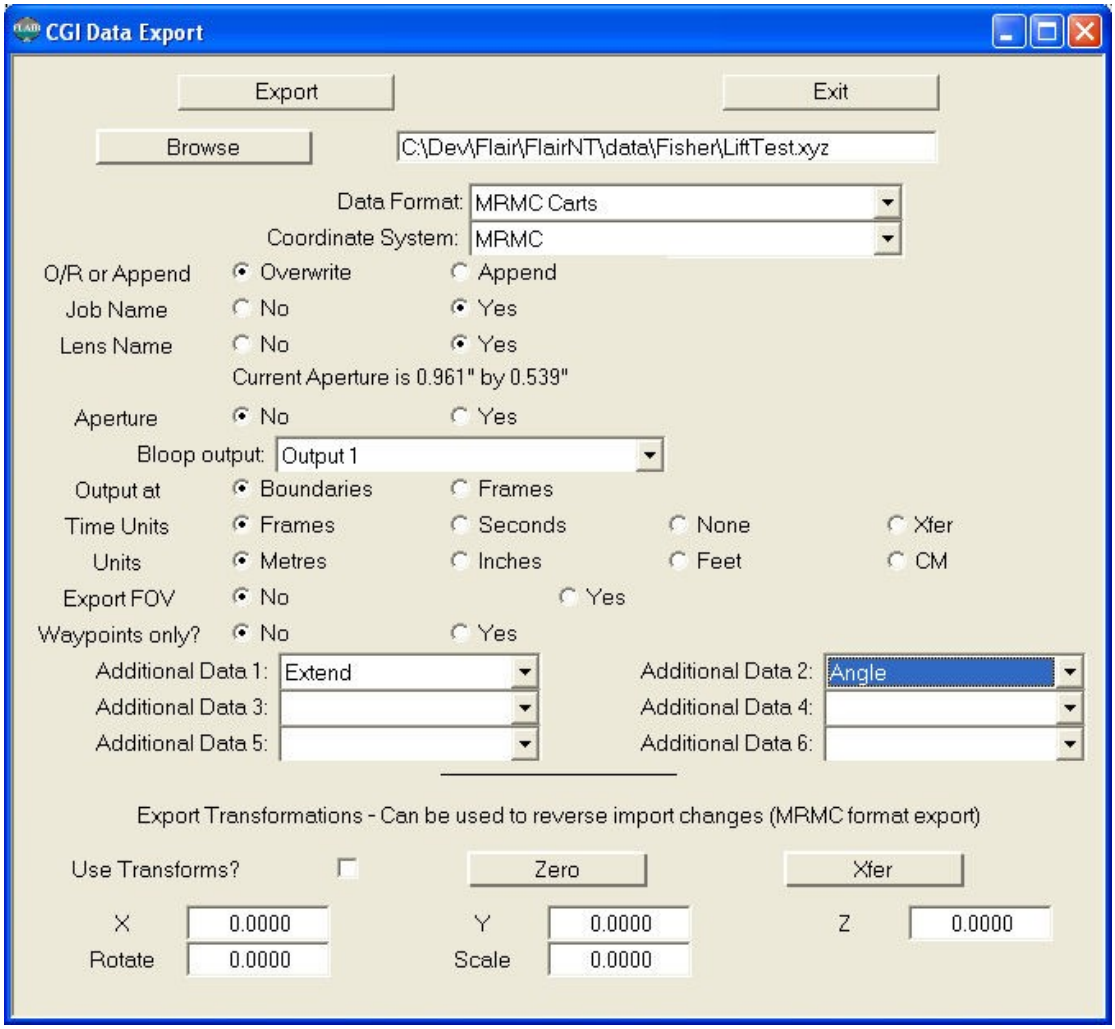
Introduction:

CGI Data is imported and exported as ASCII information with lines of data defining at very least the XYZ Co-ordinates of the Camera and the XYZ Co-ordinates of the Target, or the orientation of the camera. Each line can optionally also contain time information, camera roll, and well as positional information on up to 8 other axes.

During both CGI import and CGI Export, an "Action in Progress" box will appear to inform you of the progress of the import or export and allow you to interrupt it if so desired.

CGI Export

Data can be exported from the Flair program in a variety of ways and in a variety of formats. The CGI Export Dialogue can be used to specify the data file that you want to export to, the format you want to use and several other options making the data export flexible and informative.



Export: This button causes the data to be exported in the selected mode to the selected destination.

Browse: The export file can either be typed straight in or you can use a standard file selection dialogue to select the file you wish to export to

File Data Format: The available formats are:

MRMC Carts: The data will come out as an XYZ co-ordinate of the camera, an XYZ co-ordinate of the target and the roll angle, once per frame.

MRMC 3Node: As with the Carts Raw data, but instead of a roll axis, the Up Point is exported. This mode is ONLY valid when in Roll Up.

MRMC Eulers: Euler (pronounced "oiler") angles are the 3 angles that define the direction in which something is looking. Pan, Tilt and Roll are a good enough model of these angles for our purposes. In this format, the Location of the camera is output in MRMC Co-ordinates, and the Pan, Tilt and Roll angles are presented with Pan positive being to the left and Tilt positive being up and the Roll is as above.

MRMC Axes: Here just the raw axis positional data is exported, for Track, Lift, Rotate etc. This has been provided for those who would model the rig themselves, or for interfacing to cranes and dollies with encoders.

Kuper format: Exports data in the same form as Kuper™ motion control software.

Lightwave format: Exports data in a Lightwave™ motion file (Old version).

MRMC Carts Curve: This output format has been developed in order to improve interfacing with certain CGI packages. The data is exported as curves instead of discrete (per frame) information and this format should only be used with special software that can interpret the data.

Please note that in the Kuper format, none of the later options have any effect and in the Lightwave format, only the units makes a difference.

Coordinate System:

MRMC: The standard Mark Roberts coordinate system which has X forwards along the track, Y to the left and Z is up; Pan is positive to the left, Tilt is positive up and Roll is positive when the image rotates clockwise.

Softimage: Softimage co-ordinates are different and are common to many 3D packages. In their system, Y is vertical with up being positive, X is to the side with positive to the right and Z is positive backwards along the track.

Kuper: Kuper's coordinate system is similar to Softimage's but there are subtle differences.

Maya Y Up: This is the default Maya co-ordinate system, and the MRMC co-ordinates are manipulated to match.

Maya Z Up: This is not the default co-ordinate system and is not recommended though it does share Z up with the MRMC system. However, a tilt of 0.0 will point a “Maya Z up” camera at the ground.

Lightwave: Lightwave(tm) has yet another way of representing the camera and target and this mode is provided here.

3DMax: Likewise for 3DMax(tm).

O/R or Append: Allows you to select if you are going to overwrite any existing data with this output or append it to the bottom of an existing file. If “Append” is selected and the file already exists, it will be opened and the data will be appended to the end of the file, otherwise a new file will be created.

Job Name: Includes the name of the job into the file as a comment if “Yes” is selected.

Lens Name: Includes the name of the lens into the file as a comment if “Yes” is selected.

Current Aperture: The currently set aperture is displayed here so you can include it in the file if so desired. The camera aperture is not controlled or defined by Flair, but you can select it in the Rig Model display and this data is useful for transferring data to and from CGI.

Aperture: Select “Yes” to include the aperture in the exported file.

Bloop Output: It is very useful to have the data as to which frame the Bloop fired on together with the CGI Data. This toggle allows you to state which output was used for a Bloop, and then the first 5 firings of that trigger will be listed in the CGI output file as a comment.

Output At: "Boundaries" or "Frames". This could also be described as "Centre Shutter Closed" or "Centre Shutter Open" In a standard move, the position at frame 0 and frame 1 etc. are the shutter closed positions, the data for export to CGI usually requires the shutter open position. Select "Frames" for the shutter open position and "Boundaries" for the shutter closed position. If you output a 100 frame move on boundaries, you will get 101 lines of data, in frames mode you will get 100.

Time Format: "Frames", "Seconds" or “None”. “Frames” is a more universal format as the “Seconds” format is camera speed dependant.

Units: The Flair system works in metres internally and is the default output mode, however inches, centimetres and feet are also supported.

Export FOV: The export of the Field of View as calculated by the system is optional. The accuracy of this data really depends on how well you have set up your lens and since the field of view is really dependant on the format and many other considerations, it should be considered as a guide rather than an absolute. Feedback and suggestions from customers on this topic would be welcome.

Waypoints Only?: If selected, then only the waypoints of the move are exported which can create a smaller file for testing rather than having to export the entire move.

Additional data 1-6: Sometimes the movement of other axes can be important for CGI work. In order to provide a means to put all this data into one file, the user has the option of outputting positional data of up to 6 other axes with the standard CGI data file. This could be from model movers or any other axis. A blank label indicates that the option is turned off, otherwise simply select the axis whose data you want to output and click on the "Export" button.

Export Transformations: When data is imported from CG very often they want to have the data back again as it is usually modified or changed slightly to make it more workable. You can use the import transformation used when data was brought in to convert the export data back into the same space as it originated.

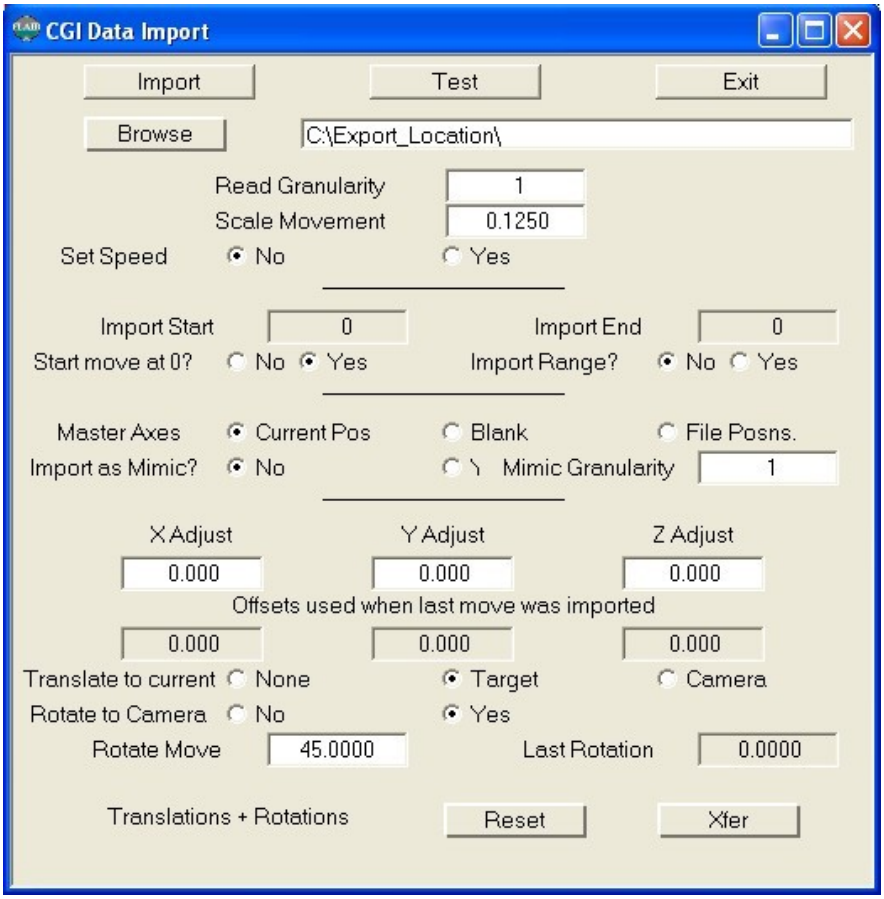
If “Use Transforms” is checked, then the listed transformations are applied so as to undo the transforms used on import.

“Zero” zeros outs the values in the transforms and “Xfer” copies the transforms used on import into this display. You may also edit the transforms, but only very advanced users would do this under normal circumstances.

CGI Import

CGI Import is a process that requires some knowledge of the data you are trying to import as well as a good understanding of the limitations of the rig you are using.

File Data Formats: The file data format is determined from the header at the top of the import file. See the section above on data export for more details on data formats. More exact format data can be found in the Technical Section at the end of this Manual. The file formats that are supported are: Any Flair Export file, any Kuper export file and a Lightwave™ motion file. (.mot) (This format is now outdated)



Import: Causes the data to be imported with the currently set configuration.

Test: Checks if the file is in a correct format and has a recognised header.

Browse: The import file can either be typed straight in or you can use a standard file selection dialogue to select the file you wish to import from. It is the user's responsibility to make sure that the file conforms to MRMC standards of import format. Please see the Technical chapter for more data.

Read Granularity: If you do not want to import every single line of 3D data, you can select to read every 2nd or 3rd line or more. In this way a large move can be read in without having a waypoint for each frame. Obviously if you want it to follow absolutely exactly, you would leave this at 1. In many cases when you are importing data, I would tend to import only as much data as is needed to rough the move in unless you need it followed very closely. A large number of waypoints is very hard to manage and almost impossible to edit or scale in time. This figure can be set to a high number when you are working with a move to get it imported and working out the best offsets to use, and then set back to a low number when these are figured out.

Scale Movement: The imported Cartesian data can be scaled to match units between systems. A value greater than 1.0 will scale it up. The file should state in the header what the units it is in and this should be automatically compensated for by the import routine, so additional scaling can be done here. This, of course, is ignored if the import file is axis positions instead of XYZ data.

Set Speed: Sets whether the move speed should be set to the speed in the file or not.

Start Move at 0?: Flair moves start at 0 by default, and often imported moves will start at some other frame count relating to the scene they came from. If you select "Start at Zero", the imported frame counts will be offset to start at zero and increment from there.

Import Start & Import End: If IMPORT RANGE is set to yes then the Import Start and Import Stop will be accessible and allow one to specify from which frame to which frame the imported file should be read and imported.

Master Axes: "Current Pos", "Blank", "File Posns". Perhaps the biggest challenge when importing XYZ data into a MRMC motion control rig is deciding what to do with the Master Axes. The simplest handling is to set the Head into Keep Head Level and extend the arm out to its maximum; this handling however does not give you the full range of motion of which a Milo or Cyclops is capable. When you are importing the data, the Master axes can be left as blank fields in which case they will remain wherever they are, or each waypoint can have its current position entered. If you import the move with blank fields and then set "Priority to Cartesians" in the Job Type display, you can play around with different positions for the Master axes without changing the imported move at all.
"File Posns" if for use with imported curves and means that the position stated in the import file is used to control the master axes if they exist.

Import as mimic: The data is imported as above, but only the first line of data and the last line of data have a waypoint assigned to them, the rest of the data is imported as a Mimic move and the imported axes are set in Mimic mode when the data has been imported. This allows all the data to be imported and followed implicitly without having to have huge numbers of waypoints. This data can also then be edited, scaled and adjusted.

X, Y& Z Adjust: These boxes allow for offsets to be set for adjusting the move around as it is read in. The units are in metres. This has no effect when importing axis data instead of XYZs.

Offsets used when last move was imported: Is a series of 3 boxes that show you the offsets used to achieve one of the "Translate to Current / Match Current" options.

Translate to Current: "None", "Camera" or "Target". Used to facilitate matching offsets between the CGI system and the MRMC system. If you have a move to import that starts aimed at a specific known point in space, then you can point the rig at that position and set the focus to that distance. If this flag is set to "Target", the entire move will be offset so that the start point of the imported move matches the point you are currently targeted on, or the position of the camera.

(Alternative selection which is displayed when you are using Head kinematics)
Match Motion to Head: If you are importing a move from a motion control system into just a head for shooting background plates, the relative motion of the camera nodal point is pretty much irrelevant for distant background plates and can be ignored. Since moving a large motion control system to the top of a mountain for a background plate can be a chore, this feature will be available if your system is just configured as a

head. In that case you can import the standard XYZ file and the important pan, tilt and roll data will be extracted.

Rotate to Camera: Sets whether the imported data should be rotated so that the first line of data matches the current camera pan angle.

Rotate Move: Allows the move to be rotated about the vertical axis as it is imported. The units are in degrees. No other rotations can be performed during import. This is also ignored if the data being imported is axis data.

Last Rotation: Shows the rotation angle used when the last move was imported if "Rotate to Camera" was selected.

Translations + Rotations Reset: Sets the translations and rotation values to 0. This is useful if you are resetting something or importing a different move that may have other import values.

Translations + Rotations Xfer: Set the translations and rotations values to the last used translation and rotation values.

How these are used: Much work has gone into importing data in the Flair system, and a workable way of getting the data in correctly has been worked out. This system relies upon using a line up frame or position. Usually we will agree that Up is Up, and often the scale of the data is known. What is not known is how to rotate and translate the move to make it work in the real world. To handle this, the easiest thing is to place the camera in the virtual world in a position that can be duplicated in the real world and use this to define these values.

If you had to shoot a move that went around a doorway, and that move had been pre-visualised in a CG package, then put the Virtual camera a known distance from the doorway with the camera level and the cross hairs directly in the middle of the door. Export that position as a "move". Now place the real camera in exactly the same position, making it the known distance away from the door, with the camera level and the cross hairs exactly in the middle of the door. The video tape should now show the same image as the virtual camera sees (minor differences in lens distortion not withstanding).

Now the camera is in the right place to match the virtual camera. So import the camera "move" with the translations and rotations set to 0.0 and the option "Translate to Current" set to "Camera" and "Rotate to Camera" set to "Yes". If you have got this right, then the positions shown in the numerical read out should closely match the current axis positions. If you run the move, the camera should stay almost exactly where it is with maybe only a slight "Goto".

If you have that right, then you have discovered the rotational and translational differences between the 2 systems, so "Xfer" those values into the Translations and Rotations, switch the "Translate" and "Rotate" flags off and you are ready to import the actual move. Once done for a set up, it should work with the same values from there on out as long as nothing changes in the Real World or Virtual World's space. Please also read the section below on "Matching Motion Control to CGI" as this will also have a major bearing on what you are doing.

MRMC Format XYZ Information:

The XYZ data is printed out in the form that we understand and use for Target Tracking. It may not match the way other 3D computers think about 3D space. See the chapter on Technical Information for more data on this. Incidentally, it seems that every CGI and Motion Control system uses a slightly different co-ordinate system!

Matching Motion Control to CGI

The first thing to know is that this process requires some skill and understanding. One cannot expect to import or export the data and have it work perfectly first time. On the other hand with some care and a little experience it should be relatively simple to get a good match.

System Set-up:

Any XYZ data imported into a 3D-software package from the Motion Control system is only as good as the system set up. If the scalings or the zeros on the rig are not correct, then the data will be incorrect to that degree. An angular offset of as little as 0.1° can make a difference, so it is important to make sure that the rig is set up as well as possible. Even the lens used can make a difference to the exact position of the tilt and pan axis zeroes if they are not properly aligned. Experience will tell you what is important and what is not. Even the stiffest rig will bend and flex under gravity and the XYZ co-ordinate output cannot be expected to be perfect. From our experience, final output accuracies of 5-10 mm are good, but this really depends on what you are shooting.

Image transfer:

Images shot on film are generally Telecined and then imported into the CGI system via tape or disk recorder or some storage medium. The film to tape 'Telecine' process can be expected to change the shape of the picture somewhat. What you see on the film and what actually appears on the screen when it is displayed may well be two different things. The Telecine process can crop, scale and squeeze the image and may not give you full gate with the correct aspect ratio. The video import process can also change the aspect or pixel ratios, and this can lead to the image not matching the CGI world. A handling for this is to make up a large grid of exact known size and shoot a few feet of this for each lens. Then after the Telecine and video import, compare this image to a virtual grid which you can create on the CGI system. If these two do not match then you can identify the problem and correct it. It is also important to make sure that the centre of the grid is in the centre of the cross hairs so that you can see if there is any lateral or vertical shift.

Lens distortions:

Since Lenses vary with manufacturer, model and serial number, there is no way of modelling them all accurately in CGI. The above test is also a good way to tell how much your lens is distorting. This is usually not critical if the objects of interest stay centre screen. If they move towards the edges then lens distortion can create some image mismatch. In this case the CGI image may have to be animated to provide correction. Be particularly careful of Zoom lenses. Typical aberrations include non-linear zoom tracking (banana effect) and distortion of the image while zooming

(pincushion effect). In addition to this the exact position of the eye point (nodal point) moves as you zoom (up to 1.5 feet on some lenses). There is no easy way to determine the exact field of view even if you have a rough read out of the zoom axis position. Further research is ongoing at Mark Roberts Motion Control to see how far these factors can be predicted, but for the moment, be aware that these things can cause image mismatch.

Shooting a chart while running through just the programmed zoom can assist calibration. This should be done on a chart that has clear markings and recording exactly how far the chart is from the lens. This can be used to create a virtual grid and lining it up with the exposed image will give a good idea of the actual change in focal length. Note that the important distance to record is the front nodal point to the chart. Since the front nodal point moves, this causes further problems which you will have to work with or around.
It can also be a good idea to shoot a pass with no zoom motion to help to eliminate problems in the line up. Non-standard lenses, such as Macros and Anamorphic, raise further issues.

Co-ordinate zeros:

The typical co-ordinate zero for a Mark Roberts Motion Control Rig is on the floor in the middle of the rails under the centre of the turret when the rig is at zero itself. XYZs are measured relative to this point. The typical zero on a CGI system is where the main object is placed; at the origin. This means that even if the axes are matched and scaled properly (our values are in metres) then the mismatch in the zeros may cause some confusion. The correction for this is simply translations in the three axes of the move and of the interest point. This can be done once the move has been imported, or can be done by offsets, which can be set up in the import software. The amount of translation can be worked out by measurements but could also be done by eye, correcting for the line of vision at the start and at the end of the move. If you have a specific frame where the target is exactly in the centre of frame, you can use that for the line up, but the distance from the object is harder to match as it may be a Focal Length or Field of View adjustment that is needed.

Matching Co-ordinate Axes:

Of course, everybody agrees that up is up, but there is no guarantee that what the Camera thinks of as forwards is directly aligned with the CG world A good handling for this is to select a couple of points that are common to both the real world and the CG world. In many cases, there are walls or objects that are in both or can be set up in both or possibly even the actual product if it is a commercial. Use the Flair Camera System to survey 2 or more points, measuring the distance from the camera to them with the cross hairs lined up exactly and storing this information as a move. This will then locate the image in 3D Flair Space and you can export the data to the CG package, model the same object in CG and see that the real world and CG worlds line up. By using 2 or more points you will be able to determine the rotational and translations adjustment needed to get the 2 to match (As well as any scaling factors).

This technique has also been used in reverse with good results. Generate a move in the CG world that exactly locates points that will appear in the real world, then when the data is imported, you will know how to get them to line up through rotations and translations.

Additional Data:

When shooting a move that will subsequently be exported into the CGI world take some measurements of specific parts of the scene relative to the rig. Also shoot a pass with an object of exact known size and position in the centre of the screen. A one-meter cube is good for most live action situations. Smaller and larger cubes should be used as per the scale of the shoot (e.g. tabletop etc). The cube is lined up parallel to the rails and shot with a simple pass, preferably with no zoom. This can then be used to correct the translations to achieve the best match. Often in the heat of the moment on a shoot these 'extra' actions can get squeezed out, but they can save you hours or even days in post production if they are done properly.

Other Export Data – The Print Menu

A large amount of data from the computer can be printed out in order to get and keep records of moves and Set-ups for later reference and use. This data export function is accessed by using the "Print" button on the File pull down which then provides you with a list of the available options. The majority of the output data is printed out in simple ASCII (American Standard Code for Information Interchange).

Waypoints:

When you select to print out the waypoints, only the positions as stored in the waypoints are printed out along with the associated frame counts. A heading is printed out giving the axes names, and the column titles.

Key XYZs:

This data as well as the following item is provided in MRMC co-ordinates. The data of the waypoints is printed out converted into 3D space. Thus the data comes out as an X, Y and Z of the Viewpoint and an X, Y and Z of the Target. There are these 2 sets of co-ordinates for every entered waypoint of the move. This button will only work when a valid target tracking move has been entered. If you are using Mimic on a target tracking axis, the output XYZ data is NOT accurate due to the change in position occasioned by the mimic motion.

All XYZs:

When this is selected, the entire move is printed out in XYZ form, with a pair of XYZs, one for the Viewpoint and one for the Target for every frame of the move. A newline character is output after every pair, and an end of file marker is placed at the end. See note above on use of Mimic with XYZ data in target tracking.

Positions:

The position of each axis for every frame is printed out along with the frame number. There is no 3D co-ordinate data output in this form. If you are in target tracking, then the positions resolved for each axis for each frame are printed.

Velocities:

The velocity of each axis at every frame is printed out for the entire move. This feature is not supported in target tracking.

Axis Configs:

The axes configuration files can be printed out to be kept as a record of the move. The full data is also stored with the job, but if you need to keep this data for any reason,

then these can be printed out and referred to as needed. This data should be printed out and kept as a hard copy in case of accidental loss of data in the system.

Lens Configs:

The offsets and data about every lens on the system can also be printed along with any motor data that may be needed to drive the lens correctly. This data should also be printed out and kept as a hard copy in case of accidental loss of data in the system.

Kinematics:

The kinematics configuration of the rig can also be printed out and kept on file as a record. As above, this data should be printed out to safeguard against accidental loss of data.

Stopping the printing:

While you are printing out data, you are prevented from doing anything else as this may change the move, and thereby invalidate the data. If you start printing some data and realise that you want to stop, simply press the mouse stop button, and the printing will stop.

CHAPTER 19 - ZEROING

Introduction:

The process of Homing or Zeroing, both meaning the same, is used to let the computer know exactly where each axis is. The process usually involves moving each axis to a known point, either by the user or the program, and referencing from that known point. The accuracy of this depends on how exactly that known point can be sensed by the user or computer. Once zeroed, an axis can be controlled to not hit its limits of travel, and can be used to provide accurate Target Tracking information. When the computer powers up, it assumes that all axes are at zero and before a move is shot it is a good idea to Zero all the axes. If the system is properly zeroed, it is possible to shoot the same shot weeks apart and still have them match even though the rig has been turned off and on many times.

Styles and variables connected with zeroing are set up for each axis in the Axis Set-up Display.

Basic principle:

When an axis is zeroed by the computer, it is moved in a certain direction set by the Zero Velocity value until it reaches a sensor, once the sensor is detected, the axis slows down and stops. If the sensor is not detected within a certain time (Zero Time), then the zeroing will stop and an error will be reported. Once the computer has stopped on a sensor, it moves the motor slowly away until the sensor can no longer be detected and this point is used as a reference point to zero the axis. The axis is then moved further away from the sensor by an amount set in the Zero Offset value to its standard Zero point and then the axis position is set to the Zero At value which is usually but not always 0.0.

Reference Points:

There are basically 3 different types of reference mark which the computer uses. These are the Slipping Clutch, Datum Switch and Limit Switch (There are 2 variations of each of these last 2 types of switch). The slipping clutch method depends on the axis being driven to one extent of its travel, and then the slipping clutch allows the motor to continue moving even though the axis has stopped moving. When this has happened, the axis is at a known position, and this is taken as the reference point. The Limit switch and Datum switch are the same type of switch, but are wired in a different way. The Limit switches are wired so that the axis automatically trips out, under all circumstances except when zeroing, when the switch opens, and the Datum switch is wired so that the computer can detect when it opens, but no other action takes place.

Switch Accuracy:

Since a magnet or roller switch is not very accurate, when one of these types of switches is used, the zero marker pulse (a very accurately marked position from the encoder) of the motor is used in conjunction with the switch to make zeroing more

accurate. Once the switch has stopped being detected, the computer waits for the next zero marker pulse from that axis, and uses that as a reference point. Using the zero marker pulse is more accurate if there is no possibility of the motor moving in relationship to the load. With a slipping clutch of any kind, it would be impossible to use the motor zero marker pulse as this would not be in a known relationship to the travel of the motor. If the motor has no zero marker pulse or the load moves, then you can use another type of switch which is more accurate than a magnetic or mechanical switch. This is normally an Optical Electronic switch (Opto for short). When one of these switches is used, it is considered accurate enough by itself, and the motor zero marker pulse is not used.

Where is Zero?:

Unless you are working with a target tracking axis, Zero is wherever you want it to be. Usually Zero is about in the middle of the travel of an axis and in its normal rest position. For an animation table, the table Zero position is usually when the camera is looking directly in the middle of the table. For a target tracking axis, the Zero position is very important and must be set correctly, particularly for rotational axes. The track position is not so important and can be chosen by the user, the rotate Zero position is with the arm pointing directly down the track, the lift Zero position is usually with the arm level (This can vary, contact MRMC if you have any questions). If there is an outer arm, its Zero position is with the pan axis absolutely vertical, the pan Zero is looking directly ahead, and the tilt axis Zero is looking absolutely level. If the rig is properly zeroed, you can run the track up and down, and the viewed point on the far wall does not move.

Different Styles of Zeroing:

Direct:

In Direct Zero, the axis is considered to be at 0 wherever it is. The motor does not move and search for a sensor. This method is usually used when there is some accurate witness mark to reference off, and the axis can be moved by the user to this point, and then Zeroed. This can also be used as a quick means of setting an axis to 0 if exact positioning is not important. Note that if you have set a Zero At value, then whenever you direct zero an axis its position will be set to the "Zero At" value.

Limit Zero:

There are several styles of Homing which involve using sensors, and this is one of these. The limit in this case is usually a magnet switch or similar which has a dual function of preventing the axis from travelling too far and for providing the reference point. Under normal conditions if this sensor is detected, the axis will turn off. When you have selected this style of zeroing and are zeroing a specific axis, this feature is temporarily overridden. With this style of zeroing, the motor zero marker pulse is used to make the zeroing more accurate.

Datum Zero:

Very similar in operation to the Limit Zero except that the switch will not under normal operation cause the axis to be turned off, it is specifically used for the purpose of zeroing. The disadvantage with the Limit style zero is that the axis will have to travel all the way to one end of its travel in order to detect the limit, and in some cases, especially with rotate axes, this can be a long way away. With the datum

switch, it simply travels until it detects the datum switch which will have been positioned away from the normal area of operation of the axis, but not too far away. (If you start zeroing on the wrong side of this sensor, then you will go all the way to the end of travel without detecting it!). Once reached, the operation is the same as with the Limit Zero.

Limited Rotate:

A rotational axis can be limited to less than a turn, can turn more than one turn but not indefinitely, or it can go round indefinitely. When the axis can go round indefinitely, then you usually use a Datum switch to zero it, and it doesn't really matter which turn it is on, as there is no difference from one to another (unless the motor to output gearing is not an even number). If the axis can turn less than one revolution, you can use limit Zero or datum Zero, whichever you like. If the axis can turn more than one turn, but not indefinitely, it is termed a "Limited Rotate" axis and it introduces its own special set of problems. Since a detection of a normal datum switch does not inform the axis in which rotation it is, and since going too far can cause the wiring to be torn out, there is often some special gearing done and a special zeroing system made. If this is the case, then it will have to be set up by Mark Roberts Motion Control to avoid undue problems, but the system is explained here if you need the data.

A special disc is set up that represents the travel of the axis, and this disk turns less than 1 turn for the entire travel of the axis. There is a vane on half the disk, and a sensor to detect the vane. From this sensor, the computer can detect if the axis is in one or other half of its travel. Sometimes there is also a datum limit on the axis which operates just as this sensor is changing state from one half of the travel to the other (The vane by itself it not accurate enough). Often this disk can also have limit switches on it to prevent the axis pulling its own wiring out.

Slip Zero:

A slipping clutch zero is just another way of referencing an axis. It is most commonly used for applications like driving lenses as these can be hard to fit limit switches to, especially if they are hired in just for one shoot. The axis as normal will move in one direction at a speed set up in the Zero Velocity box for a specific time; when the Zero Time expires the computer will consider that the axis has travelled all the way to one end of its travel, and will use that as a reference. The axis will then move away by the Zero Offset. Once the axis has moved this amount, the position will be set to the Zero At value which is normally 0, but can be changed if convenient. In order for this system to work, the axis must have a joint that can slip somewhere in the drive mechanism, or it would simply trip out when it got to one end. The tightness of this slipping clutch is critical both to repeatable operation and to zeroing. Consult MRMC if you have any questions regarding this.

Opto Datum & Opto Limit:

These are the same as the Datum Zero and Limit Zero respectively but these styles use a more accurate switch and do not depend on the zero marker pulse of the motor. Also can be used where the travel of the motor is very limited.

Errors:

Time Out:
If the sensor is not found within the Zero Time, the zeroing will "Time Out" and a message will appear. The handling for this is to increase the time allowed, start the axis closer to the switch, or find out why it is not detecting the switch, depending on the situation.

Axis Disengaged:
This means that you have tried to zero a disengaged axis. Engage the axis and try again.

Axis Inactive:
This means that you have tried to zero an inactive axis. Reactivate the axis and try again.

Axis Tripped:
The axis was engaged, but tripped out. The most common cause for this is that the emergency stop button is pressed in. Other causes are some motor or amplifier fault preventing that axis from moving, or the axis is already on a limit (could also be caused by a wiring fault). The handling is to get the axis to power up and move normally on the Hand Held Box and try again.

Zero Marker Pulse too close to Limit Switch:
This is an error specific to the Limit Zero and Datum Zero styles of zeroing. Since they reference off the zero marker pulse, if it occurs too close to the sensor edge, then this can cause errors. In this case, move the motor or encoder relative to the load by 1/2 turn and try again. This error should only occur when you are setting up the axis. This error means that the Zeroing MIGHT be inaccurate, it does not mean that it failed, just that you could be 1 motor turn away from the intended zero.

Zeroing Stopped:
This occurs when an axis is stopped by the user during its zeroing process.

What kind of zeroing style to use?

Setting up the zeroing style depends on many factors, and a good understanding of the whole principle is required to make a correct decision in every case. Here are some guidelines that will help you sort out the best solution for most cases. If you have a particular application which you are having trouble with, call Mark Roberts Motion Control for more assistance.

For most axes that are not lenses, the best style to use is Datum Zero. This means that you have the accuracy of using the zero marker pulse of the motor combined with the ease of use of a datum switch which means the axis does not have to travel all the way to the end of its travel to find the limit. The datum switch has to be positioned carefully, it must not be too far away from the normal operating position of the axis, and it must be in a position so that you are VERY unlikely to try and zero the axis when it is the wrong side of the switch.

For lenses or for axes where you cannot easily fit a limit switch, you can use direct zero or slipping clutch zero. Direct zero is the easier to set up, but it requires that you set the axis to its correct position by hand. If your lens or axis is very delicate, you may not want to use slipping clutch, and therefore the best option is using a direct zero.

Setting up an axis to Zero:

Getting the zeroing correctly set up is vital for easy operation of a rig and for target tracking. The accuracy of target tracking is often totally dependent on the axis being correctly scaled and having the correct Zero point.

1) Ensure the axis is correctly scaled.
2) Choose the Zeroing Style using the above information.
3) Decide which end of travel or which switch you are going to reference off
4) Set the Zeroing Velocity to the correct direction (sign) and set its value to about 1/20 of what you expect the axis maximum speed to be. Somewhere between 2.0 and 5.0 is usually a good point to start.
5) Set the Zero At values to 0, and the Zero Offset values to 0. Set the Zero Time value to roughly how long you think it will take to reach its reference point in seconds.
6) Position the axis approximately at its zero position.
7) Zero the axis.
   Conditional: If the axis goes too fast, too slow or the wrong way, fix the velocity and repeat.
   Conditional: If the axis times out before reaching the end point, increase the Zero Time.
8) Allow the axis to reach the limit or datum switch, and observe that it slows down, reverses direction and stops. (If it is slipping clutch Zero, it will hit the end of travel, the motor will keep turning for a while and then stop).
   Conditional: If you get an error stating that the zero marker pulse is too close to the limit switch, move the limit switch a little, or turn the motor relative to the load by 1/2 turn and repeat from step 6.
9) Verify that the axis position has been set to 0.
10) Move the axis on the hand held box to its Zero position EXACTLY.
11) Go into the Axis Set-up display for that axis, and using the mouse store button, store the current position into the Zero Offset box. The axis current position as read out on the top of the screen should now be shown in this box. Apply this value.
12) Zero the axis again. If the reference point is a switch, it will move slowly off the switch and stop again, then it will move by the amount specified in the Zero Offset and stop. It should now be at the correct Zero Position. If it is not, repeat from step 5. It should move to the reference point and stop.
13) If the Zero position is correctly set up, but you want it to Zero At a different non-zero position, then adjust the Zero At value. One possible use is to Zero the Track to the middle of its travel, measure the distance from the end of travel, and put this number into the Zero At box. This would mean that the track axis position would relate to how far down the track it was. A fade shutter for example should Zero to an open position, and in that open position should read 180 degrees, this would be set up by making it Zero to the open position, and then setting the Zero At value to 180.

14) Save and Apply the changes that you have made to the axis Set-up. If you have set up a lens, check the Chapter on Lens Set-ups for additional information about saving this data with the relevant lens.

Re-Zeroing after a system Shutdown

If the system is improperly powered down for any reason, then when the system is re-started, you are offered the option of zeroing the rig at its last known position. This can assist in bringing the axes back to their normal zero position for re-zeroing. If the lift was high in the air with the pan and roll turned through more than 180 degrees, and the power to the system was suddenly shut off, you will be faced with having to bring the arm down and move the pan and roll around to get them into a position to zero. When the system is re-powered, you should be presented with the option of setting the axes `current positions to the last known positions, and then you can do a "Move To Home" and you should be close to the normal Zero position of the rig, from which is it easy (an imperative) to re-zero.

This feature works by recording the current positions of the axes to a file every few seconds. When the program is closed down, this file is deleted. When the program is fired up and this file is found to exist, it assumes that the last time the program closed down, it was done improperly, and so offers to zero the axes at their last known positions. Please note that this was the last saved position and can be slightly wrong if the rig was moving. Always re-zero afterwards.

CHAPTER 20 - TECHNICAL : INFORMATION, ASSISTANCE AND ERRORS

Assistance:

If you have arranged telephone support for your system, then you can call Mark Roberts Motion Control during normal office hours, or leave a message on the answer machine, and we will attempt to resolve your problem as quickly as possible. If you are reporting a problem or a fault, please follow the guidelines for doing so. If you simply have a technical question, please check that it is not fully answered in the manual first, but if you really cannot sort it out don't hesitate to call.

Reporting faults or problems:

If you need to get technical assistance due to a problem or fault, then it is vital that the data you report is accurate and complete. Statements like "It doesn't work" or "It went funny" are not likely to lead us to help you resolve the problem. There are many component parts to the software and the hardware and an accurate report of what happened can often help us to track down the problem quickly. The data that is needed can be summed up as

1) When and how often did the fault happen.
2) What part of the program were you in when you observed it.
3) What sort of problem is it, a glitch or a complete crash etc.
4) Description as accurately as you can give it of what happened.
5) Other data that is useful is the status of the lights on the front of the root box, i.e. is the Error Light on, or are there error lights on any of the axis boards. Also as the program is running, some messages appear on at the bottom of the normal Flair Window and are printed into a file called “Flairout.txt” or “FlairNTout.txt”. The contents of these files can be useful in tracing down faults, and they should be copied off the system or renamed as needed as they will be overwritten when the program is next loaded.

Flair Software Wish Request and Problem Report Forms

In Flair, there is a menu which brings up forms to be used when a problem or bug is found in the software or when requesting a feature to be added to future releases. This facility is found in the Help Menu.
Remember that when reporting a problem, it is very important that we have all the information needed to repeat the problem at Mark Roberts Motion Control, or else it’s not possible to fix it. You may have to send a copy of the job you are having trouble with.

Information:

Every time the flair program loads, it writes the time and date into a file called "FlairLoad.txt ". Every time it is closed down under user control it writes that time and date into the log; communication errors causing the program to shut down are likewise recorded. If the programme fails with the dreaded “Flair has encountered an error” message it will not be recorded, but you may be able to “Hot Boot”. This file is

for user information about times and timing and may help to provide work hours after a shoot.

A second file "FlairOut.txt" is newly created every time the program starts which contains diagnostic information. Every time the program is started the previous file is overwritten.

"FlairData.txt" records every time a move is saved or run in camera record mode. Job stores are saved with the appropriate filename and time stamp, move execution is also time stamped and has the move frame counts recorded as well.

Output & Input Data Format:

Here are a few samples of output data format. The full interface is continually improved and refined and new features added, but the following samples should indicate the basic layout.

Sample outputs:

Example 1

```
# Flair Export file from Flair 3.5 Wed Apr 5 12:24:39 2000
# Job name is CARTS.JOB
DATA_TYPE CARTS_RAW MRMC_COORDS IN_METRES
POINTS 3 SPEED 25.00 TIME 0.08
Frame   XV      YV      ZV      XT      YT      ZT      Roll
  0  3.92808  0.00000  0.00039  5.73808  0.00000  0.00056  0.00000
  1  3.92808  0.00000  0.00039  5.73808  0.00000  0.00056  0.00000
  2  3.92808  0.00000  0.00039  5.73808  0.00000  0.00056  0.00000
```

Example 2

```
# Flair Export file from Flair 3.5 Wed Apr 5 12:56:41 2000
# Job name is EULERS.JOB
DATA_TYPE EULER_RAW MRMC_COORDS IN_INCHES
POINTS 3 SPEED 25.00 TIME 0.08
Frame   XV      YV      ZV      Pan     Tilt     Roll
  0 154.64876  0.00000  0.01537  0.00000  0.00542  0.00000
  1 160.71220  15.38167  14.24776  9.91823  14.06550  5.00000
  2 166.77565  30.76334  28.48014  21.13271  27.66877  10.00002
```

Specification: (Further explanations are in the Data Import/Export chapter.)

- Any line starting with "#" is ignored and can be used as a comment. Several comment lines are generally exported with a Flair Export giving the time, date, filename of the saved file and other useful information that does not directly affect the camera path.

- Each line is terminated with a CRLF character which is 10, 13 in Dos and just 13 in other systems.

- Lines should not be more than 120 characters long and should be constrained to 1 screen width if possible. (80 Characters)

- All separate entries are white space delimited. Either Tabs or Spaces are recommended.

- The first valid characters in the file should be “DATA_TYPE” This is followed by a string that indicates the data designation which can be one of: “CARTS_RAW”, “CARTS_CRV”, “EULERS_RAW”, “EULERS_CRV”, “AXES_RAW”, “AXES_CRV” , “3NODE_RAW” or “3NODE_CRV”.

- The next string designates the co-ordinate system being used and can be one of the following: “MRMC_COORDS”, “SOFT_COORDS”, “KUPER_COORDS”, “MAYAY_COORDS” or “MAYAZ_COORDS”.

- The following string designates the units used and can be one of the following: “IN_METRES”, “IN_INCHES”, “IN_FEET”, “IN_CENTIMETRES”.

- An optional string may follow which will designate the curve type which can be one of the following. (This string is ONLY expected in the case of a curve format of data).: “SPLINES”, “BEZIERS”, “LINEARS”, “CUBICS”, “QUADRATICS”, “QUINTICS”. Most of the forms are not currently supported.

- An additional optional string may follow which will designate the form of control used on the head in the case of a Milo, Cyclops or similar rig configuration: “KEEP_HEAD_LEVEL”, “KEEP_HEAD_NINETY”, “KEEP_HEAD_CRNP”

- The second valid line contains data about the move as to number of points, camera speed and move duration at that speed. The titles are self explanatory and the numerical entries are standard numerical entries – see sample.

- The third valid line is a header line which defines the columns. The first column must be headed either “Frames” or “Time”. This indicates is the time units are in frames or in seconds. Then follows a number of headers which must either be one of the valid axis names on the system or one of the valid Cartesian data titles which are: “XV”, “YV”, “ZV”, “XT”, “YT”, “ZT”, “PAN”, “TILT”, “ROLL”, “XH”, “YH”, “ZH”. Note that the use of the target points “XT”, “YT” etc would preclude the use of the Pan and Tilt angles. This is NOT checked for in the software. Case is ignored, but we would recommend keeping Cartesian Pan, Tilt and Roll is capitals for ease of differentiation and this may be adopted into the standard at a later date. The “ H” points are the Up points for the camera to make the horizon correct and are ONLY valid with 3Node camera data.

- If you are importing Cartesian data, the strings Pan, Tilt and Roll are assumed to be Cartesian data if you are importing Eulers format data before they are interpreted as axis data.

- If you wish to leave a column entry as blank, then use a comma to delimit the data and a blank entry will be assumed. (EG “12.324 34.543 –23.45 , 12.89” will give 5 entries, the fourth of which is blank.)

MRMC Co-ordinate description

The X axis is positive forwards along the track, the Y direction is horizontal at 90 degrees to the track and is positive going to the left when viewed from behind, Z is vertical and positive is upwards. Pan is positive to the right, Tilt is positive up and a positive roll rotates the camera anti clockwise so the image turns clockwise. All 3D co-ordinates are relative to the camera track, and the 3 origins and orthogonal axes do not move as the rig moves around. The zero values for the co-ordinates vary, but in general, 0 in X and Y is in the middle of any rotate when the track is zero, and zero Z is the floor.

Advanced Configuration:

There are several configuration features of the program that are not set through the program, but with a text file known as a resource file. This is roughly based on a standard X Windows feature, and has been utilised in this program to allow configuration of some features that are unlikely to change very often. This allows extensive variation of how the program behaves without cluttering it up with vast amounts of configuration Set-ups.

It is not recommended that you modify these files unless you know exactly what you are doing, and keep a backup copy of the files before you modify them. It is possible to adversely affect the program through mistakes or errors written into these files.

The configuration file for the program is called “Flair5.ini”. The following is a list of the application resources that the customer may (at his own peril) modify and what they mean.

The NAME is what must be typed in at the beginning of the line in the “.ini” file, the type tells you whether to enter a number (integer), True/False (Boolean) or text. Fractional numbers cannot be used. A brief description of the resource’s function is provided on the right, for more data contact MRMC. The format for making an entry is:
The order of names is not important.

*Name: Value

For example, the resource “SoftAxes” can be set to 21 with the following line:

*SoftAxes: 21

NAME	TYPE	FUNCTION
"Hardware"	Integer or Text	Type of hardware attached to the system. “None”, “Transputers”, “Buffer”, “Intime”
“Developer”	Boolean	“TRUE” or “FALSE”
"TargetTracking"	Boolean	Does the system have Target Tracking?
"MouseJog"	Boolean	Can you use the mouse button over the current position to Jog the axes?

"KeyboardJog"	Boolean	Can you use the keyboard when the cursor is over the current position to Jog the axes? A&Z Axis1, S&X Axis2 etc.
"SoftAxes"	Integer	Axes controlled by system, not including camera etc.
"LoadBoards"	Integer	Number of Axis Boards to load with software.
"ShownAxes"	Integer	Number of axes displayed on the screen at one time, default is 8, 10 is wise maximum.
"ShownPos"	Integer	Number of shown positions/waypoints in the screen default is 14, you can squeeze in about 20-22.
"Boards"	Integer	Number of boards required for system.
"VTRs"	Integer	Number of VTRs attached.
"ComputerFocus"	Boolean	Computer controlled focus?
"Lenses"	Integer	Number of available lens configurations.
"TableFocus"	Boolean	Does the system have a table focus system?
"Scaling"	Boolean	Is the scaling feature available?
"CamExternal"	Boolean	Can the system sync to an external camera?
"CamInternal"	Boolean	Does the system have a camera axis?
"CamHasCap"	Boolean	Can the capping shutter be controlled?
"CamHasTus"	Boolean	Can the take ups be controlled?
"CamHasRack"	Boolean	Can the Viewing Image be racked to Take Position
"TuAxNo"	Integer	Axis number of Take Up axis tension control.
"TuMajor"	Integer	Port Number of Take Up tension output.
"TuMinor"	Integer	Board number of Take Up tension output.
"MimicBoard1"	Integer	Board number of the first mimic board.
"MimicBoard2"	Integer	Board number of the second mimic board.
"MimicBoard3"	Integer	Board number of the third mimic board.
"MimicBoard4"	Integer	Board number of the fourth mimic board.
"FDX"	Integer	0 = no FDX, number = FDX mechanical design type
"Acode"	Text	Default code to load on axis boards
"AcodeN" N =1-9	Text	Axis board specific code
"Link"	Text	Name of the Link device to load the rootbox over. This is usually "//./RB1"
"Rcode"	Text	Code to load into the Root – usually root.btl
"Tcode"	Text	Code to load into the RTC – usually rtc.btl
"Scode"	Text	Code to load into the Serial Tram – usually serial.btl
"LensDir"	Text	Directory path to the stored lenses
"LensStoreDir"	Text	Directory path Default is : "configs\\"
"JobsDir"	Text	Directory path to job storage
"IconicDir"	Text	Directory path to Iconic jobs storage
"ConfigDir"	Text	Directory path to the configs
"TextDir"	Text	Directory path to the Text config files
"DataDir"	Text	Directory path; Default is "data\\"
"Heads"	Integer	Default is 1

"KineModel"	Text	Kinematics Model. Choices are: “Panther”, “Cyclops”, “Juno”, “Simple Dolly”, “Head”, “Orthogonal”, “OffHead”, “Overhead”, “Table” contact MRMC for specifics.
"Debug"	Integer	Set the software debug level.
"ScreenWidth"	Integer	Screen width in pixels, if different from full screen
"ScreenHeight"	Integer	Screen height in pixels,if different from full screen
"AutoStoreJob"	Boolean	Auto Save the job when run?
"DisableWayp"	Boolean	Default value of disable waypoint option.
"StopContinue"	Integer	Default value of Stop-Continue option.
"ModelBoards"	Integer	Number of model mover axis boards inserted in the axis chain before rig axis boards **
"ModelBoard1"	Integer	Actual Board Number of the 1st Model Mover Board
"ModelBoard2"	Integer	Actual Board Number of the 2nd Model Mover Board
"ModelBoard3"	Integer	Actual Board Number of the 3rd Model Mover Board
"FrameOut"	Integer	Frameout: None, Horita or RIC
"TCReader"	Integer	TCReader: None Horita or RIC
“SpaceMouse”	Boolean	“TRUE” or “FALSE”
"DataInput"	Boolean	Start Program with DataInput enabled?
"DataOutput"	Integer	Start Program with DataOutput enabled?
"HotBoot"	Boolean	Attempt to Hot Boot the Root code?
“RootCode”	Text	Default is “.\\root.exe
“Reset”	Text	Default is ".\\btls\\winroot.rta"
"PPI_Timeout"	Integer	PPI timeout in tenths of a second - Default 30
"Precal_Timeout"	Integer	Precalc timeout in tenths of a second. Default 300
"ToolTips"	Boolean	Show Tool Tips?
"FlairColour"	Boolean	Use Flair Screen Colours or use Windows Grey
"FlairMenus"	Boolean	Use Old Flair Menu Layout or new Windows version
"MeasureType"	Integer or Text	Measure in "Metres", "Centimetres", "Feet", "Inches" or "FeetNInches"
"FramesPerFoot"	Integer	Default frames per foot 16 for 35mm, 8 for Vista etc
"DefaultFps"	Integer	Default camera/system speed – usually 25 FPS
"DefaultFrameInc"	Integer	Frame count increment when adding a line – default value is 100
"LimitStop"	Boolean	Stop the move if an axis hits a limit/trips out?
"Hertz"	Integer	Root Cycle frequency 50 or 60 Hz
"ActualPos"	Boolean	Display axes actual positions as opposed to calculated/desired positions?
"BigJoysticks"	Boolean	Large Range Joysticks in system?
"DialogFont"	Text	Font for Dialogues
“MiniLCD”	Boolean	“TRUE” or “FALSE” Default is “FALSE”
“DefaultFont”	Text	Default Font
"BigFont"	Text	Font for Status display
"GraphicsFont"	Text	Graphics Font
“GraphicsTitleFont”	Text	Graphics Title Font

"GreyGrid"	Boolean	Axis positions display is White? or Grey
"AutoIncFiles"	Boolean	Automatically Increment Job number in suggested file names
“DoPartRuns”	Boolean	“TRUE” or “FALSE”; Default is TRUE
“EasySelect”	Integer	Default is 1
“OneBox”	Integer	Default is 1
"CurrposPoint"	Integer	16 Would be 16 point, 12 is default etc.
"DefaultPoint"	Integer	" "
"GraphicsPoint"	Integer	" "
"StatusPoint"	Integer	" "
"GraphicsTitlePoint"	Integer	" "
“LineMenu”	Boolean	
“RootServerAddress”	Text	Address of the root server; default is “127.0.0.1”
“RootServerName”	Text	Name of the root server; default is Localhost
“RunAgain”	Integer	Default is 0
“DebugPort”	Boolean	Default is FALSE
“Tyler”	Boolean	Default is FALSE
“RigModel”	Boolean	Default is TRUE
“FilmBox”	Boolean	Default is FALSE
“Iconic”	Integer	Default is 1 (Off)
“RICMimicBoards”	Integer	Default is 0 Do not set different to one above!
“RICServoBoards”	Integer	Default is 0
“RICStepperBoards”	Integer	Default is 0
“MimicCheck”	Integer	Default is 1 (On)
“FastBoot”	Boolean	Default is TRUE
“ResetRIC”	Integer	Default is 1 (No), other choices are 2=“Yes” and 3=“Query”
“KillRtApp”	Integer	Default is 1 (No), other choices are 2=“Yes” and 3=“Query”
“KillRtConsole”	Integer	Default is 2 (Yes), other choices are 1=“No” and 3=“Query”
“TabbedSetups”	Boolean	Default is TRUE
“RemoteServerAddress”	Text	Default is 127.0.0.1
“RemoteServerName”	Text	Default is Localhost
“UseRemote”	Boolean	Default is False
“IntimeMemory”	Integer	12 (12MB) is the default
“AutoBackup”	Integer	Default is 0
“GroundGlass”	Integer	Default is 11
“MSA20”	Boolean	Default is FALSE
“Stereo”	Boolean	Default is TRUE

** (Model boards) This feature has been added due to the fact that Model Mover boards are normally inserted in line with the axis pipe and therefore would cause all the rig axes to be assigned to a different board. This would mean you would need a separate configuration for each model mover set-up which adds complexity and redundancy. The handling for this is to use these settings to inform the system of how many model mover axis boards are being inserted in the axis pipe and the actual board

number of each one. In this way, the system can automatically adjust the board numbers of the rig axes without the user having to adjust that. In actual fact, the Model Mover Boards are considered to have been added to the END of the pipe and in the axis setups, they are numbered appropriately.

You can nest files in the .ini file, and this is done by adding a line such as:

*include: ini/Milo.ini; if you do it cyclically the program will hang.

Text Config Files:

As mentioned earlier, you can also import a text file that configures the system in various ways. The data imported in this fashion is NOT checked, so the user is responsible to make sure the data is accurate and sensible.

The Data that can be imported is categorised into Axis Data, Camera Internal Data, Camera External Data, Kinematics Data or Miscellaneous Data. Headings in the file determine what category the following data will be assigned to if it is valid. The headings are entered in the file as the Category e.g.(“Kinematics”, “Internal_Camera”, External_Camera”, “Miscellaneous”) or the Axis Name. The actual information is entered in much the same was as above, here is an example:

Kinematics

*Arm Length at Zero: 1.92

Rotate

*Maximum Acceleration: 30.0
*HHB Acceleration: 8.0

The valid titles in each category follow along with the options or a brief description. For full details please refer to the relevant section in the Setups Chapter of the manual.

Axes:

"Type"	Integer or Text	"Independent","Algorithmic","Target Tracking", "MasterType", "FocusType", "ZoomType", "IrisType", "FDXType", "Shutter", "D to A", "Min Aux"
"Display Scale”	Float	Display Scaling Factor
“Internal Scale”	Float	Internal Scaling Factor
“Direction”	Integer or Text	“Forwards” or “Backwards”
“Brake”	Integer or Text	“No” or “Yes”
“Board”	Integer	Board to which axis is connected
“Port”	Integer	Port on board to which axis is connected
“Maximum Velocity”	Float	Maximum speed in display units

“Maximum Acceleration”	Float	Maximum acceleration in display units
“Maximum Jerk”	Float	Maximum Jerk in display units (Not Used)
“Maximum Limit”	Float	Maximum amount positive axis can travel
“Minimum Limit”	Float	Maximum amount negative axis can travel
“HHB Velocity”	Float	Top speed of motion on the Hand Held Box
“HHB Acceleration”	Float	Acceleration used with the Hand Held Box
“HHB Jerk”	Float	Jerk used on the HHB, can be 0 or about 3x the acceleration
“Mimic Controller”	Integer	Mimic Axis controller. Use Axis number.
“Mimic Scaling”	Float	Scaling from controller axis to controlled axis
“Mimic Deadband”	Float	On SpeedBoat type, range of no motion on controller in encoder slots.
“Mimic Window”	Integer	Samples or mimic data to smooth 0 – 20
“Mimic Type”	Integer or Text	"H.H. Box", "Encoder Pos", "Encoder Vel" or "Speed Boat"
“Postroll Factor”	Float	Fraction of max acc to be used on postrolls
“Preroll Factor”	Float	Fraction of max acc to be used on prerolls
“Goto Factor”	Float	Fraction of Axis Vel & Acc to be used when doing a Goto.
“Run Factor”	Float	Fraction of Axis Vel & Acc to be checked against when doing move checking.
“Zero Offset”	Float	How far to move off from the zeroing sensor to get to the correct zero position.
“Zero At”	Float	Position to be set to once zeroing is complete. Usually 0.0
“Zero Velocity”	Float	Velocity to start seeking zeroing sensor/limit
“Zero Time”	Float	Time in seconds to allow to find sensor or fail
“Zero Style”	Integer or text	"Direct", "Limit Zero", "Datum Zero", "Limited Rotate", "Slip Zero", "Opto Datum Zero", "Opto Limit Zero”
“Signal Gain”	Float	Gain to be used in motor tuning.
“Tacho Gain”	Float	Feedback dampening gain to be used.
“Integral Gain”	Float	Offset positional correction gain.
“Units”	Integer or Text	"No Units", "Metres", "Centimetres", "Millimetres", "Inches", "Feet", "Degrees" or "Radians"
“Gripstick Velocity”	Float	Maximum velocity to use when under Grip Stick control
“Gripstick Acceleration”	Float	Maximum acceleration to use
“Gripstick Gain”	Float	Gain to use to amplify gripstick signal
“Gripstick Moving Friction”	Float	Friction to apply proportional to speed

“Gripstick Static Friction”	Float	Constant static friction
“Gripstick Deadband”	Float	Deadband range for gripstick
Motor Size	Integer or Text	"Normal", "Medium", "Small"

Internal_Camera

“Maximum FPS”	Float	Maximum speed of the camera
“Maximum Acceleration”	Float	Maximum acceleration of the camera, usually around 40 Frames per second per second
“Encoder Lines”	Float	Encoder lines per frame exposed
“Zero Offset”	Float	Fraction of a frame between the zero marker pulse and correct camera zero position
“Forward Offset”	Float	Fraction of a frame that the camera can turn before the shutter starts opening.
“Back Offset”	Float	Fraction of a frame that the camera can turn backwards before the shutter starts opening.
“Slate Speed”	Float	Speed at which the slate should be shot
“Slate Frames”	Integer	Number of frames to expose on each slate
“Direction”	Integer or Text	"Forwards", "Backwards"
“Cap Time”	Integer	Seconds of time required for capping shutter to close
“Signal Gain”	Float	Gain to be used in motor tuning.
“Tacho Gain”	Float	Feedback dampening gain to be used.
“Integral Gain”	Float	Offset positional correction gain.
“Shutter Angle”	Float	Shutter Angle on camera usually about 180.0
“TU On Board”	Integer	Board which controls the Take Ups On/Off
“TU On Port”	Integer	Port which controls the Take Ups On/Off
“TU Dir Board”	Integer	Board which controls the Take Ups Fwd/Back
“TU Dir Port”	Integer	Port which controls the Take Ups Fwd/Back
“Cap Board”	Integer	Board which controls the Capping Shutter On/Off
“Cap Port”	Integer	Port which controls the Capping Shutter On/Off
“Rack Board”	Integer	Board which controls the Rack View/Take
“Rack Port”	Integer	Port which controls the Rack View/Take

“Ramp Frames”	Integer	Number of frames of film required for the external camera to ramp to speed
“Sync Frames”	Integer	Number of frames at speed required for the camera to stabilize, usually only 1 needed.
“Sync Type”	Integer or text	"Off", "VTR Sync" or "Film Sync"

Miscellaneous

"HHB Factor"	Float	Percentage speed to run the Hand Held Box
"Goto factor"	Float	Fraction of the calculated speed at which to execute Gotos. Used to Slow them down!
"Transfer Speed"	Float	Speed at which time will be transferred, usually 24, 25 or 30.
"Browse Axis"	Integer	Axis number to be used for browsing the move.

Kinematics
The strings and values to be used in the kinematics section are shown on the kinematics setup for your system and vary from system to system

If you are importing a Text Config file and any error occurs, the import is aborted at that time. For information of what has been imported or what the error was, look at the output file under "Help" menu "View Output File". Errors that occur should be explained in that file, or consult MRMC.

The Rig Model displays can also save some data but as this is under development the format of these files is not yet finalized.

ERRORS:

Error Messages:

Error messages appear on the screen in a dialogue box titled "Error". The likely errors that you may run into are listed here as well as any pertinent information.

No Job:
There is no job entered to be run, either there is only one waypoint, or the start and end times are the same.

No Target Distance Entered:
A Target Tracking Job has been entered, but the target distance has been omitted in one or more waypoints.

No Time for Waypoint:
The time value has been omitted from a waypoint that needed to be set.

Target Tracking Not Selected:
You have tried to do a target tracking function but this flag is not on. The most likely occurrence is when you try to look at the 3D graphics, but have forgotten to turn on Target Tracking.

Frame Count may not go negative:
Negative frame counts cannot be entered into the system, but it is possible to use one of the speed modifying functions and attempt to generate a negative frame count. This is an error and is flagged as such.

Job has a length of 0 frames:
Self explanatory. If the move as you see it does not have 0 frames, try clicking on the numbers display under the "Displays" button on the Top Menu Bar, the screen will be re-displayed and it is possible that a change occurred but did not get reflected on the screen.

Function not yet implemented:
We at Mark Roberts are dedicated to the expansion and development of our product. Due to this, it is possible that some work may have been done on adding a feature but that feature has not yet been completed. If this happens and you try to access the feature you will get the above message. Contact Mark Roberts Motion Control for a release date for forthcoming features.

Clear Job Failed - Incorrect run state for clearing the Job:
The attempt to Clear a Job failed. Try again. The most likely cause would be that the system was in a run state of some kind such as "Ready to Goto" etc. If it was in a run state, then get it out of that state and back into the normal idle state before re-trying. (Use the mouse stop button).

Printer out of paper - Printer off line - Printer I/O Error:
Various printer errors which need to be handled with the printer to get it to work.

No output currently open:
You have tried to output data, but have not stated where it is to go, or the attempt to direct the output to a location failed. Select the output correctly through the "Print" - "Print to ?" menu.

Incorrect run state for axis Set-ups:
You have tried to adjust the axis Set-ups when the computer is in a run state or a zeroing state. Get it out of that state or let it complete before trying to set up an axis.

Illegal Stretch Entry Range of stretch was reversed:
You have tried to stretch a section of the job but the frame counts are the wrong way round. Re-enter the correct numbers.

Invalid Time Entry:
One or more of the frame counts are invalid. The frame counts cannot go backwards, they must always increase as you go down through the job. Check these are correct and re-try.
You could also try re-displaying the screen information by selecting "Display" - "Numbers" and check to see if the data has been corrupted.

Axis cannot be reset - check limits:
The system has attempted to get an axis to engage, but the limits are tripped. The axis may be out of the allowed range of its travel, or it is possible that there is a wiring fault.

Zeroing cannot be done at runtime:
When the system is ready to run, or is running, you are not allowed to home or zero any axes. Stop the system and try again.

Axis Disabled:
This message occurs when you attempt to home or zero an axis which has been disabled. Re-enable the axis and it should work fine.

Bad Move:
There is something wrong with the job. Normally the error message would be more specific than this, is there are any problems contact MRMC for help.

Scaling to 0 frames not allowed:
If you attempt to shorten the length of a job to 0 frames, the computer will catch this as an error, possibly you did not select the correct box when you typed in the new number of frames, and the number was not registered.

Less common errors and system errors:

Memory Allocation Error - Fatal:
There is a limit to the number of waypoints and data you can store in the system, however this number is huge and you are unlikely to run into this message if you have less than 100 waypoints! If the message does occur, contact Mark Roberts Motion Control as soon as possible and report it. Acknowledge the message and try again, if no joy you may have to shorten your job or re-boot.

File could not be opened - no apparent reason:
Hopefully you won't get this one! The computer tried to open a file, but failed and the internal error flag was not set to identify why it failed. Fix any obvious errors and try again.

File not found:
The file you tried to open was not found. The name is either incorrect or there is a more serious error. If this occurs during set up, contact Mark Roberts, otherwise it is almost definitely a typing or entry error of some kind.

Access disallowed:
The file you are trying to read or write has been protected. It is possible in many operating systems to protect files from being changed, and possibly someone has done this to one of the program files. Get the protection removed.

File already exists:
You are trying to create a file that already exists. This message is unlikely as the normal response is to question whether you want to overwrite the existing file.

Invalid Argument:
Some error in the file description or the way you have named it.

File read/write failure - End of File?:
An error occurred when trying to read/write data out to a disk, this would usually indicate a corruption of some kind of the file. It is also possible to get this message when you are first installing a new version of the program. In this case contact MRMC, there may be a simple handling for it.

Error occurred reading axis data to/from disc. Job write/retrieval aborted:

Some error has occurred when data was being read to or from the hard disk. This would also indicate some kind of data corruption. This can also occur if you are trying to read jobs created with a different version of Flair. Try again and if you have no success, contact Mark Roberts Motion Control.

Error occurred reading/writing data from/to Root. Job write/retrieval aborted:
When data is stored to disk with a job, the majority of the data is taken from the Root computer. If there is an error in obtaining this information, then this message will appear. Make sure that the system is not in a run state, and try again.

Job Check Error occurred reading data from file. Job retrieval aborted:

Job Check Error occurred - invalid job file. Job retrieval aborted:

Error occurred - invalid job file. Job retrieval aborted:
When a job is read in, it is checked to ensure that the job and the system have the same basic configuration and that the data is stored in a readable form. If this is not so, then you will get an error message. It means that you cannot read in the job, and it must have been stored from a different program or a different program configuration. The "Job Check" prefix means that this error was spotted while the program was testing that the data structure of the job was intact.

Error occurred - file corrupted, please re-load program:
This is very similar to the above, but in this case it has been decided that the data read in may be suspect, and there could have been some data corruption. You are strongly advised to re-load the software. You could also try reading in the job with the Simple Read function as this will read in only the actual waypoints and not the entire job.

You cannot use LPT1 for printing, the rig is controlled through it:
You have attempted to open LPT1 for data output. This is not allowed as LPT1 is used to control the rig. Using LPT1 would guarantee a system failure. This applies when you have a PC host computer, if you are using some other hardware platform, then the response may be different.

Could not open your selected output:
The output you selected to use could not be opened, select a new output.

General Errors:

"Error Communication to the root box X, More than 5 errors are fatal – Retrying"
This means that the PC (or host computer) has tried to communicate with the Root computer and failed. The most common cause of this is the root computer has stopped working, often this is because someone has turned off the power or has disconnected a communications lead. There are many possible causes, and if the problem does not resolve easily contact MRMC with details. This message will disappear is communication is restored.

It appears that an axis board has ceased functioning...
This indicates that the communications between the main transputer and the axis board has stopped working. Either a error has occurred on the axis board causing it to

cease working (check the red error light on the axis boards) or there has been some interference to the communications pipe line, either the cables have been unplugged or damaged. If the fault corrects itself, the on screen message will disappear, if not you will have to re-boot. You are able to save the job you were running in this case.

Unexpected Interrupt.....: / Flair5.exe has encountered a fault
This is a fault in the PC which has cause the PC program to crash. If this problem occurs frequently or repeatedly contact MRMC with details. When this happens however, the main program running in the root box will probably still be running. You can re-load the PC program without having to re-load the root program, and the whole system will come back up almost as though nothing had happened. (You may have to check that the move speed and frame counters are correctly set !)
Handling: You will have returned to the standard windows screen when this happens, open up the folder in which the Flair.exe program is and the double click on that program whilst holding down the “Ctrl” key. The move data will have been lost, but the axis positions should still be correct and one can simply read in the last saved job and continue from there.

If all else fails:

Turn off the power to the root and to the PC, leave it a moment, and then turn everything back on.

Troubleshooting

Problems that have occurred in the past are listed here along with the reasons and or solution to them.

The program does not load:
This can be caused by any number of faults, the first thing to do is to trace the fault. As the program loads, it puts several messages onto the computer screen telling you what is happening. The first thing that happens is the program code for the root computer is loaded and the message appears "Loading the root board" to tell you that the root is being loaded. After that the boards are loaded with program code one at a time, first Board 0 which is the timing board, then the axis boards 1,2,3 etc. If the program fails loading a board then the following message will appear “Error Loading Axis Board N Fatal. Loaded XX bytes of XXXX", in this case the problem is with that board and or the communication from the previous board. The most common reason for faults of this type is the board has been knocked loose, a cable or wire is not plugged in or is damaged or the power has not been turned on to that board.

The axis will not engage:
The axis name goes black and the axis position goes black but the axis does not move, and if you try then the axis position goes white again. This could be caused by not releasing the Emergency Stop button, by an amplifier fault or possibly by a blown fuse or otherwise. Check that the amplifier is healthy and is powered. Also check the wires to the motor and that the motor is healthy and not shorted or open circuit.

The axis position stays black even when the axis is disengaged:
This can happen if you have the axis assigned to a nonexistent board. In this case the motor you are actually trying to move will not do so.

The axis engages, but trips out after a few seconds:
This indicates that the limits are tripped. The extent of travel limits will be ignored for about 5 seconds after you try to re-engage the axis to give you a chance to move it off the limit. If the axis is not on a limit and this happens, it is almost definitely a wiring fault.
This can be investigated with the "Limits Test" option under the "Set-ups" menu.

The axis powers up, but will not move:
This is due to the soft limits or axis velocity preventing it from moving, having a ridiculously large scaling so that it moves but very slowly or possibly by assigning 2 axes to the same Board and Port.

The axis does not move with the job even though it has waypoints assigned:
If the axis does move on the hand held box, but will not move as a part of the run, then it is either in a mimic control state, or it has an invalid axis type. Make sure that you are not mimic controlling that axis, and then check that its axis type is correct. You may have to select an incorrect axis type, and then the correct one again to force the system to change the value.

The axis moves, but ticks or jumps and quite often trips out:
This can be caused by a peculiar hardware fault in the axis board. You should turn everything off and try again. Re-booting generally does NOT fix this, you have to turn it off and on again

The move cannot be modified and trying to enter numbers into boxes has no effect:
The computer is in a run state during which data entry is invalid. Take it out of the run state by pressing the stop button on the mouse or on the top menu bar.

GLOSSARY

If you don't find the word you require in the Glossary, always check the index as it may be defined within the Manual text.

Active
An active axis will run moves and will operate on the hand held box. When moves are run, the move is normally checked against the limits of the axis, and any excesses are communicated to the user. In this state, the axis name in the numbers display is shown on a button which has a 3D look to it. When an axis is de-activated, the button appears flat and the axis will not move, though it will remain under power and will hold position. In the de-activated state, it will not have moves generated for it, and no limits checking etc is done, and it will not move on the hand held box.

Algorithmic
An algorithmic axis is an axis that is controlled by the position of another axis based on a lookup table. For example one may want the focus axis to be dependent on another axis of motion but the relationship is not linear so a lookup table is used. It is a type of mimic axis.

Auto Mimic
A form of mimic control where instead of the axis being remotely controlled by a button or a hand wheel, the axis is actually moved by hand while learning, and that motion is then replayed exactly as it occurred.

Axis Board
Name given to the special board developed by Mark Roberts Motion Control that is used to control up to 4 motors. Perhaps it should really be called an Axes Board, but it is called Axis Board for historical reasons.

Bezier / Bezier Curve
There are numerous ways in fitting a curve between 2 or more point. One of the most popular curve types is a Bezier curve named after the man who first used them. In a Bezier curve section, there is a start point, an end point and 2 control points. The control points are used to control the direction that the curve leaves the start point and the second control point controls the direction from which the curve arrives at the end point.

Camera Viewpoint
The point on the camera from which we consider that we are looking from. This is normally the front Nodal Point of the lens.

Cartesian
An axis that can be used to describe a point in space in terms of its distance from a plane. The Z Cartesian is the distance from the XY plane etc. etc.

Cartesian Control
Cartesian is a system of locating a point in space by assigning three numbers to it which indicate its distance from an origin. The numbers could typically indicate the height of the object from the floor, how far it is from the back wall, and how far it is from the left hand wall. Cartesian control in the Flair system allows the user to move

the camera point or target point around by directly affecting its position in space. For example if you want the camera to go up, then you press the up button, and the axes will be driven to move the camera in a line directly upwards, but the camera will continue looking at the target while this is done.

CGI
Computer Generated Images. This term is generally used to mean any computer made image, especially animated ones which are going to be mixed with live action footage.

Computer Fairings
Fairings which are automatically determined by the computer in order to smoothly accelerate axes up to speed, and then bring them smoothly to a halt at the end of the move. (see also User Fairings).

Control Point
This is a point used in forming a Bezier curve. A control point can be used to change the direction in which the curve path leaves a point on the curve as it moves to the next point on the curve. The path does not necessarily pass through a control point, it merely heads towards it.

Convergence
In a Stereoscopic shoot setup, convergence is the angle between the left and right eye position of the camera, relative to the subject being shot.

Data Link
The communications connection that runs from the root to each axis board in turn. This link is very high speed and carries positional and instructional data to and from the axis boards.

Dialogue Box
A box that appears on the screen and allows some form of communication or interaction with the user. Dialogue boxes are used to inform the user of something like an error or some data, and are also used to get information from the user such as a file name etc. There are also specialised dialogue boxes which fulfil program specific functions. Examples are the Error Dialogue Box and the Axes Set-up Dialogue Box. Also spelled "Dialog".

Drag
To move something on the screen. Usually achieved by depressing the left hand mouse button over the item, and then moving the mouse with the button still depressed. Once the item is dragged to the desired position, the mouse button is released.

E-Stop
Short for Emergency Stop, the big red button used to totally disable all motors on the rig.

Enable
To enable an axis is to click on its name at the top of the numerical display screen so that its name turns from white to black (or red if it is a mimic axis). The intention is to get the motor to turn on and hold its position under computer control. If this works, and the axis current position goes black, then the motor is said to be engaged.

Engage
See above under “Enable”. To engage a motor is to cause it to be controlled by the computer. This is normally indicated by the current position of the axis being shown as black (or dark blue if it is in velocity read out mode).

Fade Dissolve
Any of a series of actions that can be taken to affect the exposure on film by changing the length of time that light shines on the film. With a constant speed camera, this is usually done with a movable shutter. Fade Dissolves range from fading out to black or white, fading in, or doing a total mix between 2 scenes.

Fairings
Also called "Eases", "Buffers" or "Ramps", fairings are basically the way in which the axis or axes accelerate from rest to a velocity. With simple 2 point moves, an axis accelerates up to speed during the up fairing, travels at a constant velocity, and then decelerates to a stop during the down fairing. Fairing can be expressed as frames or as percentages. The sum of the fairings will be reduced to fit within the move if they are too great, and if a fairing is set to 0, then that axis will pre-roll or post-roll.

Follow Focus
Follow Focus is a mode of operation whereby the focus axis is controlled in order to maintain focus on a stated target. This may be moving or stationary.

Front Nodal Point
See Nodal Point in this glossary.

Gate
The gate is where the film is held in place when exposure occurs in a film camera. Pins hold the film in place in the gate.

Go Motion
This is frame-by-frame animation but where the camera is moving while exposure is occurring. This gives a feeling of continuous camera movement during playback, different to stop motion. Go motion is called Moving Step in Flair and is sometimes also referred to as Motion Blur.

Goto
A movement of the system to go directly from one position to another, not as part of the move. (See also “Move To”)

Hand Held Box or HHB
The Hand Held Box is a box connected to the computer system that is used to move the rig around in space. It also has a screen on it to supply some information about the current rig state and also some function keys to allow you to run the job etc. Called a "Jog Box" on some competitors systems as it allows you to "jog" the axes around.

Homing (See also Zeroing)
A process whereby the exact position of an axis relative to a fixed reference point is established. In this way the axis can know where its ends of travel are, and thereby avoid hitting them.

Hot Key
Any key or combination of key presses that causes some action to occur in the program. Generally this is considered to be faster than accessing the same function through the mouse.

Independent Axis
Any axis that whose move is not affected by any other axis. (compare Target Tracking Axis, Algorithmically Dependant Axis).

Infinity Offset
The distance in metres that a lens moves through from the zero position to get to infinity focus. This is set up in the Lens Set-up Display.

Input Focus
The place to where input from the host computer's keyboard is being directed. This term is used with graphics user interfaces, and is used to control where key presses go to. If you have many possible input boxes on the screen, then the input focus controls which box the key presses go to. Input focus is often indicated by a highlight around the box or item that has input focus, and you can usually set a box or item to have input focus by clicking the left hand mouse button while the cursor is over it.

Interocular
In a Stereoscopic shoot setup, the interocular distance is the difference between the left eye position and right eye position.

Job
All the data associated with a move plus the Set-ups in the system which will affect the way in which it is executed.

Limits Checking
When the user requests a move to be run forwards or backwards, the computer checks the entirety of the move as well as any preroll or postroll to make sure that each axis does not exceed it maximums of travel, speed or velocity. If any of these are determined to be exceeded, the user is warned.

Master Axis
A type of Target Tracking Axis whose position affects the camera and target paths, but whose position is not controlled by them when shooting a Target Tracking move. This occurs when there are 2 axes that have the same or a similar effect on the motion of the camera. The master axis is so named as it is controlling, but is not being controlled like other Target Tracking axes.

Master Move
A master move is the controlling move used when using the Target Tracking Scaling feature. The master move is created and edited by the user as a normal Target Tracking move, and when the Slave Move is shot, the master move is scaled and moved to match it onto a scaled scene or target.

Measure Offset
The distance from the point on the camera from which you measure target distances to film plane. In the case of a Video System, this is the distance from this point to the chip/tubes.

Measure Optical Offset
The distance from the intersection of the pan and tilt axes to the measure point measured parallel to the optical axis.

Measure Normal Offset
The distance from the measure point to the optical axis measured perpendicular (normal) to the optical axis.

Measure Point
A position on the Camera or Lens which has been chosen as the most convenient to measure from. Its actual position is unimportant, but the distance from this point to the film plane must be known.

Mimic
The action of causing an axis to be controlled by another source than the curve generated from a series of waypoints during a move. Most often the axis is controlled from a handwheel or from the hand held box.

Mimic Add
A feature of the mimic option that allows the user to run a move on an axis but to perturb it by turning a handwheel. This can be used to enter rough motion into an axis, or to correct a movement that is only slightly off.

Mimic Board
If you have purchased the mimic option, it is possible that there is an extra axis board inside the root box which is used only to mimic control axes. It is connected to handwheels of some form that are moved by the user, and then the movement of the handwheel is copied to the axis you are driving.

Mimic Learn
When you are shooting a move and as you mimic control an axis, that data is being saved for later replay. It is a system state and is not axis specific.

Mimic Playback
When the previously learnt mimic move is being replayed.

Mimic Save
If you have learnt a move on an axis and want to store this move for later use but still wish to mimic other axes, you can SAVE that axis move by setting it into the mimic save state. This is done through the mimic display.

Mouse Select Button
The left hand mouse button which is generally used to selected an item or press and button. This is usual with all user interfaces.

Mouse Stop Button
In this program, the mouse middle button is used as a STOP button. When pressed, it causes any ongoing action in the system to be stopped. It is also used to disable an axis.

Mouse Store Button
The right hand mouse button is used to store data. When you are over an axis position box and you press the right hand mouse button, that axis's current position is read into that box. It is also used to read data into other dialogue boxes.

Move
A series of waypoints that can be executed. This term is similar to Job, but Job includes all the configuration data associated with the move.

Move To
See Goto

Nodal Point / Nodal Plane
The Nodal plane of a lens is a plane perpendicular to (at right angles to) the optical axis of the lens that passes through a point 1 focal length away from the focal point of the lens, closer to the lens than the focal point. The Nodal point is a point on this plane where it is intersected by the optical axis. Lenses have 2 such planes, a front and a rear, the one being referred to is the front nodal plane. If you pan a lens about this point, then there is no relative shift between close and distant objects. (No parallax shift).

Nodal Hiatus
Any complex lens system can be viewed as 2 simple thin lenses a distance apart. In this model, the distance between the nodal planes of the lenses is known as the Nodal Hiatus. This distance can vary from several centimetres or more to a negative value.

Optical Axis
An imaginary line running through the middle of the lens in the direction the lens is looking.

Periscope
A periscope is a lens that has a lens with a 45 degree mirror in it to make the lens look round 90 degrees away from the normal direction of the camera. Also called a snorkel lens.

Phase Shift
The relationship between the timing in the system and the timing of the external camera. Whilst they may both be running at the same speed, the Phase Shift is the relative timing of the 2 systems. 2 film cameras with 0 phase shift would both start exposing at the same time.

Pot / Potentiometer
Pot is short for potentiometer which is a device which allows a know or a slider to be moved to adjust a variable voltage or current. It is often used more generally to mean any device which allows the user to manual control a variable, such a dial controlling a motor position or joystick controlling lights.

Postroll
Postroll is the movement of the rig after it has ended a move or after it has been told to stop. This movement is required for the rig to slow down from the speed it was doing, and then return to the position at which it is to stop. Post roll will occur whenever a move ends or when the stop button is pressed. Mostly the postroll is non-

existent or negligible, but if a move is stopped mid way, or run to end part way through, the postroll can be quite appreciable. Postroll will also occur at the end of a move if it is being run with 0 fairings. Note that the postroll length depends on the speed of the move, the maximum acceleration of the axis and the postroll factor as well as the setting of the job type flag “Stop Quickly/Along Path”. If a postroll is in operation, a second press of the stop button will cause the rig to stop as quickly as it can, and should always be employed in emergency situations.

Preroll
Preroll is the movement of the rig taken to get up to speed at the start of a move or start of a section of a move. For example if you run just the middle section of a move, the rig has to be at speed when that section starts. In order to do this, the rig will move away in the opposite direction to the move and start a “run up” so that it is at speed when the move starts. This also occurs if you run a move with 0 fairings. Note that the preroll length depends on the speed of the move, the maximum acceleration of the axis and the preroll factor as well as the setting of the job type flag “Start Quickly/Along Path”.

Press
In a program, this term means to move the mouse cursor to an item on the screen, and then press and release the mouse left hand button while over this item. This mouse button is also called the select button.

Prime Lens
A prime lens is a lens with a fixed focal length, i.e. not a zoom.

Qwerty Keyboard
This is the name given to the standard English language keyboard. The name is derived from the top row of alphabetic keys.

q.v.
When "(q.v.)" occurs after a word in a definition in this glossary, it means that word itself is defined in the glossary and you should refer to it if you are not sure of its meaning in the context that it is used. It is a normal dictionary abbreviation and comes from the Latin "quod vide" which means literally "which see".

Radians
Radians are scientific units used for measuring rotation. 1 radian is approximately equal to 57 degrees.

Radio Button
A series of buttons that show different states. Similar to a toggle button but each state has its own button and when any one is selected, any other selected button are automatically deselected. See the Mimic Display.

Reverse Kinematics
Refers to the process that converts camera position and orientation information into motor positions. Reverse kinematics is complicated by extra axes such as the Milo’s angle and extend axes, and in these cases, multiple solutions are possible.

Rig
A term used to encompass the mechanical structure supporting the camera. Also referred to as "The Camera", but this term is avoided in this manual due to obvious potential misunderstandings.

Root
The main computer that handles all the move data and move generation and control. It is a specialised computer and is mounted on a custom made board to allow it to be used for our Motion Control application.

Roll Up
A specialised mode for controlling the roll position by defining a point that should always be up on screen, this can be used to animate the roll when there is no horizon to be kept level; such as looking at the ceiling or the floor.

Root Box
A box in which the Root computer is located. The PC actually does little more than display the data on its screen. Additionally, there may be one axis board in the root box which is used for mimic purposes. The Rootbox has been superseded by the newer version which has the Windows system and the root process all one PC and it is called the RT10.

Run time
Any time when the computer is involved in running a move, whether it is ready to move to the start, moving to the start, ready to shoot, pre-rolling, actually running or slowing down it is said to be in or at run-time. At this time many operations that would change the move are invalid and are not allowed to take place.

Run state
The state that the system is in when it is at run-time. Run time states are: Ready to Goto, Going To, Ready to Shoot, Pre-rolling, Shooting, Post-rolling and Locking Sync.

Scaling
1) Scaling is a feature whereby a camera and target path can be moved in space and scaled in size so that the shape remains the same, but the size of the paths and their physical location in space is changed. This can be used to match 2 moves on different scale items together. See Master Move and Slave Move and the end of the chapter on Target Tracking for a fuller description.

2) Scaling also refers to the number required to convert the position of the axis motor (in encoder pulse counts) into useable units. There are 2 axis scalings, one is the Display Scaling and the other is the Internal Scaling. The Display Scaling converts the position of the motor into units which the user wants to see (usually inches, degrees etc) and the Internal Scaling converts the motor position into scientific units (Metres and Radians).

Scroll Bar
A control bar used to display a large amount of information through a small screen. The data is viewed as though through a window, and using the scroll bar, one can slide the data underneath up and down or side to side so that all of it can be viewed.

Select
To click the left hand mouse button while the mouse cursor is over an item on the screen so that its action is undertaken, or to make that item active so that information or data may be entered into it.

Slave Move
The slave move is the result of scaling a standard target tracking move to fix it onto a scene of a different scale such that the path shape and relationships between the camera and the target remain the same. One use of this would be to enter a move on a man, then replay it as a slave move onto a model. In this case, the 2 moves would look identical.

Slider Bar
A bar that is used to set a value to a variable amount or is used to show the current value. The bar has a small block in the middle which is used to display the value within its allowed set of ranges. The numerical value is often displayed just above this block.

Snorkel Lens
See Periscope in Glossary.

Soft Limits
Soft Limits is short for software limits which are the maximum and minimum allowed positions for an axis, entered into the software Set-ups. This value is checked by the software to make sure the move does not exceed this value.

Speed Profiling
Changing the speed at which a move is executed without affecting the path or the overall time that it takes to shoot the move.

Target Tracking
A mode of operation in which the move is viewed as a 2 paths, one for the Camera View Point and the other for the Target Point. The computer moves the axes so as to produce a specific path, not simply moving axes as a collection of Independent Axes.

Target Tracking Axis
Any axis that whose position affects the path of the Camera View Point or Target Point. Examples of these axes are Track, pan & tilt. (compare Algorithmically Dependant Axis, Independent Axis).

Toggle Button
Any button on the screen which represents several possible states, when pressed it cycles through the available states. The state of the toggle button is usually indicated by the text in the Button. Most have 2 states, but some have 3 or more possible states. Example: the Stop Motion/Moving Step toggle which changes between these 2 states as you press it.

Transputer
A specialised computer that has been specially designed to handle high speed communications. This facility means that several transputers can be connected together, and several programs can be run at the same time, or a large volume of processing can be shared between transputers. Transputers are used in the Mark

Roberts Motion Control System. They have largely been replaced by a newer and faster Digital Signal Processor (DSP) but are still used and reliable.

Trip Out
When an axis trips out it has switched off power to the motor and engaged the brake, if there is one, due to a fault condition. This could be because of numerous reasons, such as, it has gone past a limit switch, it tried to move faster than it physically could, the amplifier power is switched off or something stopped it from moving when it tried to move.

User Fairings
Used to designate a condition when the user has control over the fairings and not the computer. See "Fairings" and "Computer Fairings".

Viewpoint
The point from which we consider that we are viewing. In most cases this is simply the camera, but in certain effects (e.g. scaling) its exact position can be of importance. It is the place that the person's eye is considered to be viewing from.

Viewpoint Offset
This is the distance from the front nodal point of the lens forwards to the viewpoint. Usually either set to 0 or to the focal length of the lens in metres.

X Nodal Offset
The horizontal distance from the intersection of the pan and tilt axes to the front nodal point of the lens. This distance is measured in metres.

Y Nodal Offset
The horizontal distance from the intersection of the pan and tilt axes to the front nodal point of the lens. This distance is measured in metres and is positive if the nodal point is to the left of the pan tilt intersection looking in the same direction as the camera.

Z Nodal Offset
The vertical distance upwards from the intersection of the pan and tilt axes to the front nodal point of the lens. This distance is measured in metres

Waypoint
A waypoint is any assigned position through which an axis moves. By assigned is meant that a position has been stored, and usually a frame count assigned. This term is interchangeable with Keyframe.

Zeroing (See also Homing)
Process whereby an axis is moved to a specific point in its travel where its position is determined to be 0.

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APPENDIX A: 37-WAY GPIO WIRING

Most MRMC systems use a 37-way D-type connector with the following connections. A diagram is also supplied showing typical types of wiring made to the inputs and outputs:

```
TRIGGER INPUT & OUTPUT CONNECTOR (37-WAY D-TYPE)
-----------------------------------------------
(FEMALE ON ROOT BOX)
    1 OUT1+      20 OUT1- (RESERVED:CAMERA CONTROL)
    2 OUT2+      21 OUT2-
    3 OUT3+      22 OUT3-
    4 OUT4+      23 OUT4-
    5 OUT5+      24 OUT5-
    6 OUT6+      25 OUT6-
    7 OUT7+      26 OUT7-
    8 OUT8+      27 OUT8-
    9 OUT9+      28 OUT9-
   10 OUT10+      29 OUT10-
   11 OUT11+      30 OUT11-
   12 0V        31 0V
   13 IN1+       32 IN1-   (RESERVED:SYNC INPUT)
   14 IN2+       33 IN2-
   15 IN3+       34 IN3-
   16 IN4+       35 IN4-   (NOT USED)
   17 IN5+       36 IN5-   (NOT USED)
   18 IN6+       37 IN6-   (NOT USED)
   19 +12V
```